MINERALS YEARBOOK

Volume III

AREA REPORTS: INTERNATIONAL

U.S. BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR

1978-79

Minerals Yearbook

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AREA REPORTS: INTERNATIONAL

U.S. DEPARTMENT OF THE INTERIOR

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Prepared by staff of the

BUREAU OF MINES

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UNITED STATES DEPARTMENT OF THE INTERIOR • James G. Watt, Secretary

BUREAU OF MINES

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, and park and recreation areas, and for the wise use of all those resources. The Department also has a major responsibility for American Indian reservation communities and for the people who live in Island Territories under U.S. administration.

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Foreword

The Federal Government, through the Minerals Yearbook and its predecessor volumes, has reported annually on mineral industry activities for 98 years. In the interest of expediting the release of minerals data, this edition of the Yearbook covers both 1978 and 1979. It discusses the performance of the worldwide mineral industry during 1978 and 1979 and provides background information to assist in interpreting developments during the years being reviewed. Content of the individual volumes follows:

Volume I, Metals and Minerals, contains chapters on virtually all metallic and nonmetallic mineral commodities important to the U.S. economy. In addition, it includes a chapter on mining and quarrying trends.

Volume II, Area Reports: Domestic, contains chapters on the mineral industry of each of the 50 States, the U.S. island possessions in the Pacific Ocean and the Caribbean Sea, and the Commonwealth of Puerto Rico. This volume also has a statistical summary.

Volume III, Area Reports: International, contains the latest available mineral data on more than 130 foreign countries and discusses the importance of minerals to the economies of these nations. Separate chapters review the international minerals industry in general and its relationship to the world economy and ocean minerals.

The Bureau of Mines continually strives to improve the value of its publications to its users. Therefore, the constructive comments and suggestions of readers of the Yearbook will be welcomed.

Director

Acknowledgments

The Bureau of Mines, in preparing this volume, utilized extensively statistical and other basic data on mineral production, consumption, and trade provided by various foreign government mineral and statistical agencies through a variety of official publications. The cooperation and assistance of these agencies is gratefully acknowledged. Statistical and informational material was also obtained from airgrams of the U.S. Department of State, from United Nations publications, and from the domestic and foreign technical and trade press. Of particular help in preparing this volume were the routine and special reports submitted by the minerals, petroleum, economic, and commercial officers and other members of the Department of State. Their contributions are sincerely appreciated.

The text and tables of this volume were prepared by the staff of the Branch of Foreign Data, Division of Production/Consumption Data Collection and Interpretation. Final correlation and checking of this volume were performed by the Branch of Publication Support Services of the Division of Publication.

The regimes of some countries reviewed in this volume are not recognized by the U.S. Government. The information contained herein is technical and statistical in nature and is not construed as conflicting with or being contradictory of U.S. policies toward these countries.

Albert E. Schreck, *Editor-in-Chief*

Acknowledgements

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Minerals in the World Economy

By Charles L. Kimbell[1]

The year 1979 was a period of increased activity for the world's mineral industry, distinctly in contrast with 1978 when estimated world crude mineral output value declined slightly and most phases of the industry's activity were somewhat curtailed. In 1979, most major mineral commodities recorded significant gains in output, with a substantial number achieving new record highs; details on trade levels for 1979 were not available, but increases over those of 1978 were expected on the basis of partial data. Consumption of most commodities edged higher; in some cases the higher demand levels were met largely through draw-downs of stocks accumulated in recent years, while in other cases notable output increases were required to meet demand.

Actually, 1978 was not a bad year for all elements of the mineral industry if changes in output levels of the various commodities are considered as a measure of performance. There were far more individual commodities registering production increases between 1977 and 1978 than registered declines, but some of those reported as declining were relatively major commodities (bauxite, aluminum, copper and zinc were notable). Moreover, the upturn in productive activity in 1978 was not matched by increases in profits. However, 1979 was unquestionably a year of renewed expansion efforts, although some commodity areas, most notably the steel industry component, were still experiencing difficulties.

During 1978-79, a number of political events—some international in scope, some confined largely to single nations—had significant influence upon world mineral supplies, and other such events had the potential of having significant impact on the world's mineral industry.

Most notable of these was the continuing crisis situation in Iran. In early 1978, industrial activity there was somewhat impaired by civil disorders directed at the regime of Shah Muhammad Riza Pahlavi. Later in 1978 major strikes and riots occurred, and as 1979 began, the Shah departed the nation, leaving the Government in the hands of Prime Minister Baktiar. Among efforts to appease the rebellious factions, that Government officially prohibited oil exports to Israel and the Republic of South Africa, although this was more symbolic than practical because total oil exports had fallen to a trickle as domestic disorders so reduced output that it was barely more than adequate to meet internal demand. It should be noted that curtailment of oil output in early 1979 was probably matched by curtailments in production of virtually all other mineral products, although reporting on such activities has been very sparse and of questionable value since the deposal of the Shah. There was evidence of some resumption of activities in the early spring of 1979 as the Baktiar regime was replaced by the provisional government of Mehdi Bazargan, the group installed by Ruhollah Khomeni, but restoration of normal economic activity was impossible owing to civil disorders that continued to plague the nation, most significantly those in oil-rich Khuzistan Province and neighboring Kurdistan, both along the Iran-Iraq border, where Arabic ethnic minorities complained of oppression by the Khomeni regime and where problems flared into open fighting with the revolutionary militia.

The November seizure of the U.S. Embassy led to a new round of problems for Iran's mineral industry—termination of shipments of oil industry equipment from the

United States, the freezing of all Iranian assets in the United States, and further displays of unrest in Iran itself, where through yearend the provisional government often was unable to establish policy awaiting decisions from Khomeni. Although reporting of general mineral industry activities has been very sparse, it is believed that almost all elements of Iran's mineral industry suffered substantially during this period.

Of less significance to the world, but with rather ominous overtones, was the U.S.S.R.'s massive military intervention in the internal civil strife in Afghanistan, in late December 1979. The nation's small developed mineral industry has little significance to the rest of the world except for modest natural gas exports to the U.S.S.R.; the landlocked country's undeveloped mineral potential, somewhat more promising than that thus far developed, seemed more of a prize. Perhaps more significant, however, was the Soviet presence in this nation, on the eastern border of troubled Iran, and near the strategic Persian Gulf Strait of Hormuz, through which must move a very large part of the oil exports from Iran, Iraq, Bahrain, Kuwait, Saudi Arabia, Qatar, and the United Arab Emirates.

Elsewhere, civil strife and international economic sanctions adversely affected mineral industry output in Southern Rhodesia during 1978-79. In this country, briefly styled "Zimbabwe-Rhodesia" and slated to become simply "Zimbabwe" in 1980, the establishment of a black majority government led to a cease-fire between government troops and rebels in late 1979, to a lifting of economic sanctions, and to publication for the first time in 16 years of detailed production statistics on the output of all major mineral commodities. These data, at least for the most recent 4 years, appear in the Southern Rhodesia chapter of this volume.

In Zaire, civil strife, intensified by rebels operating from adjacent Angola, sharply curtailed copper-cobalt mining and processing activities in the Shaba (formerly Katanga) copper belt area in May 1978, and although these problems temporarily curtailed mining activities in the area and drove cobalt prices to record highs (a 350% increase between January 1978 and February 1979), industry activities seem to have settled to a more normal level by yearend 1979.

In northern Africa, the rich phosphate potential of the Western Sahara area, formally annexed by Morocco and Mauritania in 1976, remained inoperative due to insurgent activities, backed according to Moroccan authorities by Algerian interests. On August 5, 1979, Mauritania renounced its claim to any portion of Western Sahara, in favor of the guerilla organization, leaving Morocco to continue the struggle on its own. This dispute represented only a part of Mauritania's mineral industry setbacks: The recession-status of the world steel industry curtailed exports of iron ore, Mauritania's foremost mineral product, and the country's single substantial copper mine closed in 1978.

Slightly to the south, Liberia's Government was under considerable pressure as a result of economic conditions which involved, among other elements, the depressed world iron ore market (one of Liberia's major exports) and increased petroleum prices (one of the nation's major imports).

The nations of Eastern Europe seemed to be experiencing difficulties in meeting performance goals set under the various development plans so popular in that area. Details of these shortfalls are provided in individual country chapters in this volume.

In Southeast Asia, Vietnam, just showing signs of recovery from over 20 years of warfare of one kind or another, suffered severely from the Chinese invasion of late 1978 and early 1979, and several elements of that country's mineral industry were substantially affected. In neighboring Laos and Cambodia, little progress in mineral industry development was discerned, and internal political strife continued.

In mainland China, continued improvement of relations with the west led to increased flow of information on mineral industry development and activities, and to growing efforts directed toward a "transfusion" of technology. The most prominent mineral-related commodities traded between the United States and mainland China in 1979 (following the establishment of diplomatic ties) were petroleum machinery (the United States to China) and tin (China to the United States).

In the Western Hemisphere, Mexico registered substantial economic growth based on its blooming oil industry; this growth was significantly influenced by the unstable conditions of the Near East.

In Bolivia, a successful coup by the military against the recently installed Guevara Government led to general strikes that included the nation's tin mines in late 1979, curtailing that country's mining output for the last 2 months of the year.

In Chile, mineral industry activity was strengthened as general economic conditions showed improvements; the runaway inflation rate seemed to be being curbed and new government appointments were made to the posts of economics minister and minister of mining, these jobs being filled by individuals known to be strong supporters of free enterprize and denationalization. It remained to be seen, however, what effects if any, this might have on the nation's huge copper industry.

PRODUCTION

The estimated value of world crude mineral production in 1979 was $201,300 million in terms of constant 1973 dollars, nearly 5.2% above the 1978 level of $191,400 million and 4.2% above the revised 1977 level of $193,100 million. The value increase was somewhat higher than the actual quantitative increase, however, because of generally higher unit prices in the more recent years. The following tabulation summarizes approximate data on value of world mineral production for selected years:

Year	Billion constant 1973 dollars	
	Value of 53[1] major crude mineral commodities[2]	Value of all crude mineral commodities[3]
1950	46.2	52.6
1953	60.3	69.3
1958	77.4	93.0
1963	85.6	104.9
1968	99.2	120.2
1973	159.2	189.6
1974[r]	161.3	180.7
1975	152.3	170.6
1976[r]	164.5	184.2
1977[r]	172.4	193.1
1978	170.9	191.4
1979	179.7	201.3

[r] Revised.

[1] The list of commodities included appears in table 5 of the 1974 edition of this chapter; one commodity covered in 1950-68 (beryl) is excluded from the 1973-77 figures, but the overall impact of this omission is regarded as insignificant.

[2] Data for all years except 1974-77 are as reported in Annales des Mines, December 1975, p. 13; data for 1974-77 are extrapolated from the 1973 Annales des Mines figures on the basis of the United Nations index of extractive industry production in the United Nations Monthly Bulletin of Statistics, August 1979, p. xiv.

[3] Data extrapolated from those values for 53 commodities to compensate for commodities not included in the source of that data. For details on the basis of extrapolation, see relevant text in the 1974 edition of this chapter under "Value of World Mineral Production."

The foregoing data belittle the role of the mineral industry in the world economy, however, by representing only an approximation of the value of crude production from mines, quarries, and wells, rather than the enhanced value that results from beneficiation, smelting, refining, and other equivalent downstream processing. Moreover, these data do not reflect value added due to transporting mineral materials from production areas to consuming areas. If the value added through processing—smelting of metals, refining of oil, and manufacture of basic materials such as cement and fertilizers—were included, a 1979 figure on the order of $480,000 million could be regarded as a conservative estimate of the value of output of primary mineral-processing plants. An additional, unestimated increment should also be added for the value of secondary metals produced. It should be stressed that crude and processed mineral commodities constitute not only the overwhelming dominant share of the total raw material base for all manufacturing endeavors, but also represent a significant requirement for the agricultural industries because of that industry's need for fertilizers of mineral origin as well as the overwhelmingly dominant source of energy for industry throughout the world and for individual energy requirements in all developed countries and a number of developing countries as well.

PRODUCTION INDEX PATTERNS

The following tabulation summarizes the growth in world mineral industry output as reflected by the United Nations' indexes (1975=100) for extractive mineral industry components:

Year	Index numbers (1975 = 100)			
	Coal	Crude petroleum and natural gas	Metals	Total
1973	97.3	106.9	104.6	104.5
1974	96.6	108.4	105.6	105.9
1975	100.0	100.0	100.0	100.0
1976	101.5	110.0	102.4	108.0
1977	102.6	116.2	103.7	113.2
1978	101.9	115.4	101.8	112.2
1979	106.6	122.0	103.8	118.0

Source: United Nations. Monthly Bulletin of Statistics, August 1979, v. 33, No. 8, New York, 1979, p. xiv.

Comparison between the world extractive industry indexes in the foregoing tabulation and the indexes for processing sectors of the mineral industry presented in the following tabulation demonstrate the substantially higher levels of growth in production value for downstream products:

Year	Index numbers (1975 = 100)		
	Nonmetallic mineral products	Chemicals, petroleum, coal, and rubber products	Base metals
1973	100.3	102.4	107.8
1974	102.8	105.8	110.8
1975	100.0	100.0	100.0
1976	107.7	111.6	107.9
1977	112.6	121.4	109.2
1978	118.5	125.7	114.7
1979	123.1	133.6	120.2

Source: United Nations. Monthly Bulletin of Statistics, August 1980, v. 33, No. 8, New York, 1980, p. xv.

For details on differences in mineral industry index pattern growth for various world areas, see the source publication for the foregoing tabulations.

QUANTITATIVE COMMODITY OUTPUT

Total world production of 95 distinct mineral commodities and/or specific forms of mineral commodities is given in table 1 for 1976-79. Of these commodities, 80 registered gains and 15 recorded declines in 1979 relative to 1978 output levels, compared with 70 reporting gains and 25 recording declines between 1977 and 1978, and 73 reporting gains and 22 recording declines between 1976 and 1977. Of the 48 metals commodities listed, 33 were produced in greater quantities in 1979 than in 1978; of the 36 nonmetals commodities recorded, 30 were produced at higher levels in 1979 than in 1978; and among the 11 fuels listed, all but 2 were produced in greater quantities in 1979 than in 1978. Probably the most notable decline in output in 1979 was that recorded for gold, this in the face of the upward spiraling price for that commodity.

No viable means exists to sum up the overall production performance of the nonfuel mineral industry except on a value basis, and for these commodities, exactitudes on value are not available for detailed review. Among the fuel commodities, however, a pattern of overall growth can be demonstrated by United Nations' data in which all fuels are reduced to a common energy equivalent basis. The following tabulation summarizes world energy output for 1973-79 (1979 data estimated):

Year	Million metric tons of standard coal equivalent				
	Coal	Crude petroleum and natural gas liquids	Natural gas	Hydro and nuclear electricity	Total
1973	2,426	4,247	1,539	186	8,398
1974	2,457	4,261	1,560	209	8,487
1975	2,577	4,054	1,568	224	[1]8,422
1976	2,650	4,381	1,633	232	8,896
1977	2,763	4,569	1,671	250	[1]9,254
1978	2,784	4,557	1,735	257	[1]9,332

[1] Data do not add to totals shown because of independent rounding.

Source: United Nations. World Energy Supplies 1973-78. Statistical Papers, Series J, No. 22, New York 1979, p. 14.

Total output of energy in all forms in 1979 was estimated to be nearly 2.8% above the 1978 level, which in turn was only 0.8% above that of 1977. As a result of the rapidly escalating cost of petroleum and the less-than-sure availability of oil supplies from the Near East, coal production registered a more substantial increase between 1978-79 than did the other fuels.

TRADE

In 1978, the aggregrate value of total world trade in mineral commodities reached an estimated $392,500 million, a very modest increase (only 1.7%) above the previous record high set in 1977. Comparable data for 1979 were not available in time for inclusion in this chapter; available information clearly suggested a significant increase, but was far too sparse to provide a basis for a reasonable estimate of the percentage growth. The following tabulation summarizes the growth pattern in mineral commodity trade for 1973-78, as well as the role of that trade in total commodity trade:

Year	Estimated value of all mineral commodities traded (millions)	Change from previous year (percent)	Mineral commodities share of all commodities traded (percent)
1973	$151,800	46.3	26.5
1974	[r]325,100	[r]114.2	38.8
1975	[r]312,800	[r]3.8	35.8
1976	[r]353,700	[r]13.1	35.7
1977	[r]385,900	[r]9.0	34.4
1978	392,500	1.7	30.4

[r]Revised.

Clearly, 1978 marked a pronounced change in the growth of value of mineral commodity trade, in all likelihood as the result of both a lower rate of increase in unit prices for fuel (the factor that was overwhelmingly dominant in the growth rates for both 1973 and 1974 and an actual reduction in the quantities of fuels moved. The rather pronounced decline in the share of total trade accounted for by minerals was, to an extent the result of the increasing value of nonmineral commodities, which in turn was related to minerals in that it reflected the high cost of energy in production of other manufactures.

Table 2, which served as the basis for the estimates of total mineral commodity trade appearing in the foregoing tabulation, provides reported data on the value of trade in major mineral commodity groups and total commodity trade for 1974-78. Table 3 shows the percentage share of major mineral commodity groups in the total trade of these commodities for 1974-78, and table 4 provides individual growth (or decline) rates for each of the major mineral commodity groups for the same years.

Major mineral commodity trade by region (such as tables 8-10 in the 1976 edition) may be obtained for 1974-78 directly from the United Nations' Monthly Bulletin of Statistics for May 1980.

CONSUMPTION

NONFUEL MINERAL COMMODITIES

There was an upturn in the use of most major nonfuel mineral commodities during 1978-79. In the case of some commodities, this growth in use was met by drawdowns of stocks held by both producers and consumers, with little reflection at demand increases in production; but for other commodities there were corresponding increases in output.

MINERAL FUEL COMMODITIES

Data published by the United Nations show a 2.5% increase in total world energy consumption between 1977 and 1978, a somewhat lower growth than the 3.2% increase between 1976 and 1977, and substantially below the 6.0% growth between 1975 and 1976, but well ahead of the 0.4% increase reported between 1974 and 1975. At the time of preparation of this chapter, data for 1979 was not yet available, but a level about equal to the 2.5% 1977-78 increase is suggested, with solid fuels showing the most appreciable gain. The following tabulation summarizes world total energy consumption by source for 1973-78:

Year	Million metric tons of standard coal equivalent				
	Solid fuels	Liquid fuels	Natural gas	Hydro and nuclear electricity	Total
1973	2,452	3,578	1,517	187	7,734
1974	2,489	3,535	1,545	209	[1]7,779
1975	2,516	3,524	1,545	224	[1]7,808
1976	2,646	3,770	1,633	231	8,280
1977	2,744	3,896	1,651	250	8,541
1978	2,803	3,959	1,737	256	8,755

[1] Data do not add to totals shown because of independent rounding.

Source: United Nations World Energy Supplies 1973-78. Statistical Papers, Series J, No. 22, New York, 1979.

From this tabulation, it is evident that between 1977 and 1978, growth in natural gas (up 5.2%) was the most substantial component of the overall energy consumption growth, reflecting efforts of producing nations to utilize a great proportion of their gross production of this commodity, reducing flaring, venting to the atmosphere, and reinjection to reservoirs to the maximum extent possible. Use of all other energy forms grew also, but at rates lower than that of total energy use. As a result, natural gas accounted for 19.84% of total energy consumed, only a fractionally lower share than its recorded high (19.86%) set in 1974.

INVESTMENT

Data published by the U.S. Department of Commerce relating to U.S. foreign investment in mineral industry activities show continued growth in petroleum related activities during 1976-79 inclusive, but with a sharply higher increase in 1979 than in foregoing years; in contrast, investment in mining, which advanced only marginally in 1976-77, turned downward in 1978, and then showed a considerable upturn in 1979. However, these growths, measured in terms of current dollars, would be substantially less significant if they were to be deflated to adjust for the inflation rate.

Unfortunately, reasonably comprehensive data on worldwide mineral industry activity are not available for 1979, and for 1978 only a few geographic and commodity areas are available. Table 5, showing Organization for Economic Cooperation and Development (OECD) data on steel industry investment shows the 1978 downturn reflected also in U.S. foreign mining investment data, which, together with that for petroleum, both for 1978-79, are presented in table 6. The data for 1978 presented in table 5 have not been totaled owing to the absence of figures for Japan which accounted for over one-third of the 1977 total for OECD countries.

TRANSPORTATION

MARINE TRANSPORT

Tankers, bulk carriers, and freighters are the three classes of vessels engaged in transporting mineral commodities. The number, gross tonnage, and deadweight tonnage of these vessels, as reported by the U.S. Maritime Administration for 1974-78 are given in table 7. Although there is a modest difference in reporting categories between 1974 and 1975-78, this difference (inclusion of refrigerated vessels among freighters rather than among other vessels in the latter period) is of little overall significance. It should be noted that vessels in each of the three categories are not wholly devoted to mineral commodity transport. Tankers, although largely engaged in moving crude oil and refinery products, also transport some liquid chemicals, wine, molasses, and whale oil. Bulk carriers move agricultural products as well as crude minerals and mineral fertilizers, while freighters, because of their great variety, can be wholly devoted to hauling mineral products or wholly to moving nonmineral goods, as well as carrying mixed mineral and nonmineral cargos.

Table 8 gives information on total loadings and unloadings of vessels, divided between tanker-type cargo and dry cargo, for the years 1974-78. While it is recognized that these figures on loadings and unloadings include goods other than minerals, they nevertheless serve as a reasonable measure of mineral commodity shipments, because the preponderance of total weight of all goods moved is accounted for by minerals. Some measure of the significance of mineral commodity movement to total commodity movement is apparent in data for the world's two major canals, the Panama and the Suez, and it should be noted that figures for these waterways are skewed in favor of nonmineral commodities by both waterways' inability to handle large supertankers and bulk cargo vessels engaged in ore trade. Although exact recent figures are not available, it appears likely that minerals and mineral products account for three quarters or more of total cargo carried in any 1 year on a weight basis.

Tables 9 and 10 provide a geographic breakdown of loadings and unloadings of dry cargo and tanker cargo, respectively, for 1976-78 on a tonnage basis. Again recognizing that both tables include mineral and nonmineral goods, but also recognizing the dominance of mineral materials from the viewpoint of tonnage, these tables give some idea of the relative importance of various world areas as origins and destinations for mineral materials.

Bulk Carriers.—In 1978, the world's bulk carrier fleet decreased by 281 vessels, compared with an increase of 362 vessels in 1977. This represented a 5.7% decline growth in 1978 on the basis of the number of vessels, but in terms of gross tonnage there was a 0.5% increase and in terms of deadweight tonnage there was a 1% increase demonstrating the continued gradual shift toward larger vessels. In 1978, the average bulk carrier grossed 22,423 tons and had a deadweight tonnage of 38,795 compared with 1977 figures of 21,034 and 36,219 tons, respectively. The following tabulation shows the distribution of the world bulk carrier fleet by country of registry in 1978:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Liberia	932	43,109
Greece	784	23,161
Japan	517	21,992
Norway	267	16,519
United Kingdom	252	12,227
Panama	309	7,604
Italy	151	7,503
India	104	4,382
Germany, Federal Republic of	63	5,573
Sweden	54	3,277
U.S.S.R.	150	2,895
France	52	2,762
Singapore	77	2,629
Poland	79	2,274
China, mainland	67	2,105
Brazil	33	2,041
Spain	63	2,035
Other	697	20,348
Total	4,651	180,436

Freighters.—In 1978, the world's freighter fleet increased by 1,965 vessels, a 16.1% increase. In terms of gross tonnage, there was only a 7.7%, increase and in terms of deadweight tonnage the increase was only 7.4%; thus average vessel size decreased for the first time in several years. The average freighter in 1978 had a gross weight of 6,202 tons (6,686 tons in 1977) and a deadweight tonnage of 8,341 tons (9,022 tons in 1977), a substantial decrease when the number of vessels involved is considered. The following tabulation shows the distribution of the world's freighter fleet by country of registry in 1978:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Greece	1,484	13,993
Panama	1,572	12,057
U.S.S.R.	1,801	10,858
United States	481	6,874
Japan	782	6,783
Liberia	610	6,655
United Kingdom	589	6,185
Germany, Federal Republic of	443	4,202
China, mainland	405	4,127
Singapore	428	3,749
India	220	2,583
Norway	271	2,532
Cyprus	427	2,511
Netherlands	348	2,398
Other	4,280	32,446
Total	14,141	117,953

It is noteworthy that Panama displaced the U.S.S.R. as the second ranked nation in terms of deadweight tonnage; this followed the U.S.S.R.'s loss of first place to Greece in 1977.

Tankers.—In 1978, the world's tanker fleet was 100 vessels smaller than in 1977, a decrease of 1.9%. The gross tonnage for vessels of this class declined by 1.6% and the deadweight tonnage by 1.5%. The declining number of tonnages of tankers reflected the reduced growth rates in world petroleum movement and supply. The upward trend in the average size of tankers however continued, with the average tanker in 1978 grossing 34,849 tons (34,766 tons in 1977) and having a deadweight tonnage of 65,885 tons (65,625 tons in 1977). The following tabulation distributes the world's tanker fleet by country of registry in 1978:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Liberia	883	104,308
Japan	473	31,129
Norway	315	30,738
United Kingdom	357	27,927
Greece	364	19,689
France	128	14,754
United States	302	13,924
Panama	251	12,617
Italy	226	9,487
Spain	131	9,340
U.S.S.R.	471	7,321
Germany, Federal Republic of	81	6,497
Sweden	76	6,294
Denmark	74	5,631
Singapore	112	5,538
Netherlands	63	4,293
Other	926	35,298
Total	5,233	344,780

OCEAN FREIGHT RATES

Following a general (although not universal) downturn in ocean freight rates between 1976 and 1977, the worldwide inflationary spiral accentuated by ever-increasing fuel costs had the inevitable effect of increasing shipping costs, and thus freight rates increased for both tanker cargos and dry cargos, virtually without any exception, throughout 1978-79. By yearend 1979, most of the various rates listed by the United Nations in their Monthly Bulletin of Statistics (tables published in January, March, June, and September issues) had reached levels that were nearly double to more than double the 1977 level, and in a few cases were about three times the 1977 rate.

PANAMA AND SUEZ CANALS

The Panama Canal reported overall increases in activity during both 1978-79 (fiscal years ending September 30 of each year), both in terms of the number of vessels transiting the canal and in terms of the amount of cargo moved—both mineral commodities and other commodities as shown in the following tabulation:

		Fiscal year[1]	
	1977	1978	1979
Number of transits:			
Commercial ocean traffic	11,896	12,677	12,935
Other traffic	1,191	1,131	1,427
Total	13,087	13,808	14,362
Cargo moved:			
Commercial ocean traffic:			
Mineral commodities thousand metric tons	[r]66,195	83,614	90,082
Other commodities do	[r]58,758	61,191	66,503
Subtotal do	124,953	144,805	156,585
Other traffic do	219	304	370
Total do	125,172	145,109	156,955

[r] Revised.
[1] Year ending September 30 of that stated.

At the end of fiscal year 1979 (September 30), the legal status of the canal area altered markedly, as the Panama Canal Zone ceased to exist, after 65 years of operation of the canal.

In fiscal year 1979, mineral commodities accounted for 57.5% of all commercial ocean traffic through the Panama Canal, a slightly smaller share than the 57.7% of fiscal year 1978, but greater than the 53.0% share accounted for by minerals in fiscal year 1977.

The following tabulation distributes mineral commodity trade through the canal during 1977-79 by major group:

Commodity group	Thousand metric tons		
	1977	1978	1979
Metals:			
Ores and concentrates:			
Bauxite	1,194	1,414	1,184
Chromite	132	134	160
Copper	514	696	508
Iron	2,837	1,600	1,163
Lead	254	117	144
Manganese	396	314	485
Tin	68	63	55
Zinc	628	685	739
Other and unspecified	1,140	1,383	1,524
Total	7,163	6,406	5,962
Ingots and semimanufactures:			
Aluminum	116	100	280
Copper	802	838	895
Iron and steel [1] [2]	10,296	11,478	10,763
Lead	106	147	120
Tin[1]	161	160	141
Zinc	138	157	98
Other	217	244	234
Total	11,836	13,124	12,531
Nonmetals:			
Borax	476	465	462
Cement	389	369	309
Clays, fire and china	322	266	423
Fertilizers	7,278	8,059	9,350
Salt	851	853	931
Sulfur	1,260	1,277	1,481
Other	402	398	798
Total	10,978	11,687	13,754
Mineral fuels:			
Carbon black	12	84	154
Coal and coke	13,128	11,093	14,111
Petroleum:			
Crude	12,799	32,843	30,478
Refined	10,279	8,377	13,092
Total	36,218	52,397	57,835
Grand total	66,195	83,614	90,082

[1] Tinplate is included under tin in source publication.

[2] Includes a category identified simply as "scrap" in source publication, which may include scrap other than iron and steel scrap.

In terms of the major mineral commodity groups, fuels were dominant in each year, 1977-79, increasing their share of the total tonnage from 54.7% in 1977 to 64.2% in 1979, as crude oil supply patterns were altered. Metals ranked second, with steel semimanufactures as the dominant single commodity element; among the nonmetallics, fertilizer materials were overwhelmingly dominant.

For greater detail on mineral movements through the Panama Canal, see the Panama Canal Company Annual Report series.

More recent detailed data on Suez Canal operations than that included in the 1977 edition of this chapter have not become available since its preparation, but general reports clearly show that there was an increase in the volume of cargo moved through the canal in 1978-79, although details on the role of mineral commodities in this trade are not available. Efforts to make possible the handling of larger vessels continued.

PIPELINES

Limitations of time and space preclude a detailed appraisal of worldwide progress on pipelines; major projects in individual countries are reported within the individual country chapters.

PRICES

Comprehensive data on world prices for crude minerals and mineral products are not available; tables 11, 12 and 13 summarize nonferrous metal prices in the United States, the United Kingdom and Canada respectively, for 1976 to 1979 inclusive, with monthly data provided in each case for 1978 and 1979. For these 2 years, the general trend for each of the major metals listed was upward; there were minor fluctuations on a monthly basis which can be noted from the tables, but except for the U.S. copper-zinc prices for 1978 and the Canadian zinc price for 1978, all 1978 annual average prices topped 1977 annual averages, and without exception, 1979 annual averages topped those of 1978 in all three markets.

Probably the most noteworthy price trends not demonstrated in tabular form for 1978-79 were the continued growth in fuel prices, particularly for crude oil and its products, with the obvious impact on the prices of all goods whose production requires significant expenditures for energy materials. However, rivaling these in importance was the sharp upturn in the price of gold beginning in the last few months of 1979. (A similar, although somewhat more steady, increase in silver prices is reflected in tables 11-13.) This upturn in gold, far more the result of speculative buying than any upturn based either on normal supply-demand imbalance or increasing cost of mining-processing, continued at a frantic rate at yearend 1979, with the price topping $600 per troy ounce, and although destined ultimately for a sharp decline, that point was not reached within 1979.

STATISTICAL SUMMARY OF WORLD PRODUCTION AND TRADE OF MAJOR MINERAL COMMODITIES

The final 24 tables of this chapter (tables 14-37) extend the statistical series on production that was started in the 1963 edition of the International Area Reports volume of the Minerals Yearbook and was subsequently updated and expanded in the 1965 and 1967-77 editions. They are primarily a supplement to other statistical data within this chapter but also serve as a summary of international production data for major mineral commodities covered in greater detail on a commodity basis in volume I of the 1976 Minerals Yearbook and on a country basis in the balance of volume III.

In this edition, the data presented in these tables in most instances correspond both with the data in the individual commodity world production tables appearing in volume I and in the individual country chapters of volume III. The few differences that exist are the result of the receipt of revised data for inclusion in a country chapter subsequent to the completion of the commodity chapter. The most notable example is the inclusion in these tables and in the commodity chapter of actual reported figures for Southern Rhodesia (Zimbabwe-Rhodesia), where official reports of actual output for the past 15 years became available at midyear 1980.

One of the commodities covered is reported on a different basis than in foregoing editions; nitrogen, previously reported on the basis of the nitrogen content of nitrogen fertilizers produced, is reported in this edition in terms of the nitrogen content of ammonia production. This is regarded as an improvement over the previous reporting practice in two respects. First, it represents a more complete coverage of the commodity than was the case previously, for it covers not only that nitrogen used in fertilizer production, but also that used in the manufacture of nonfertilizer nitrogen-containing chemicals (leaving only nitrogen gas not included, which is not within the scope of the Bureau's responsibilities). Second, the new series reflects the production of the nitrogen at the first measurable stage of its production, whereas the former reporting practice measured in some cases a downstream product produced in part from imported ammonia.

Regretfully, the series of data on world trade in major mineral commodities that has appeared in most previous editions of this chapter (tables 57-69 in the 1976 edition) could not be included for a second year owing to scheduling problems. Hopefully, these tables will be resumed in the 1980 edition.

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[1] Supervisory physical scientist, Geographic Statistics Staff, Branch of Foreign Data.

Table 1.—World production of major mineral commodities[1]

Commodity and unit of measure	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Bauxite, gross weight[2] thousand metric tons	78,968	83,989	82,609	88,394
Alumina, gross weight do.	26,758	29,460	29,552	30,526
Unalloyed ingot metal do.	12,529	13,676	13,437	14,507
Antimony, mine output, metal content metric tons	68,498	65,971	65,737	71,588
Arsenic, white[3] [4] do.	34,227	32,301	32,549	32,890
Beryl concentrate, gross weight[3] [4] do.	2,316	2,499	2,806	2,779
Bismuth[3] do.	3,986	4,475	4,423	4,264
Cadmium metal, smelter do.	16,773	17,935	16,765	18,260
Chromite, gross weight[4] thousand metric tons	8,536	9,228	9,025	9,580
Cobalt:				
Mine output, metal content metric tons	21,402	21,800	25,229	28,693
Metal, refined do.	18,771	19,146	22,575	26,223
Columbium-tantalum concentrates[4] [5] do.	23,080	21,618	23,560	25,109
Copper:				
Mine output, metal content thousand metric tons	7,451	7,661	7,557	7,607
Metal:				
Smelter:				
Primary[6] do.	7,251	7,497	7,435	7,531
Secondary[7] do.	518	532	489	505
Refined:				
Primary[6] do.	7,066	7,337	7,431	7,517
Secondary[7] do.	1,173	1,200	1,276	1,367
Gold, mine output, metal content thousand troy ounces	39,021	38,923	39,063	38,880
Iron and steel:				
Iron ore, gross weight thousand metric tons	882,945	840,847	854,508	909,629
Metal:				
Pig iron do.	509,286	505,743	527,800	528,355
Ferroalloys do.	12,223	11,824	11,965	13,080
Steel, crude do.	663,309	670,471	710,648	738,407
Lead:				
Mine output, metal content do.	3,303	3,406	3,445	3,513
Metal, smelter:				
Primary[6] do.	3,370	3,295	3,469	3,535
Secondary[7] do.	1,673	1,945	1,873	1,937
Magnesium metal, smelter, primary[6] metric tons	244,749	251,255	282,273	301,812
Manganese ore, gross weight thousand metric tons	24,652	22,825	22,382	24,418
Mercury, mine output, metal content 76-pound flasks	243,274	199,539	183,597	188,502
Molybdenum, mine output, metal content metric tons	88,679	95,126	100,225	101,796
Monazite concentrate (source of rare-earth metals and thorium) do.	12,070	15,791	21,573	23,634
Nickel:				
Mine output, metal content thousand metric tons	800	821	664	702
Metal, smelter do.	771	728	622	646
Platinum-group metals, mine output thousand troy ounces	5,978	6,310	6,332	6,660
Selenium metal, smelter[4] [5] metric tons	1,125	1,371	1,428	1,559
Silver, mine output, metal content thousand troy ounces	316,308	340,213	334,657	344,457
Tellurium metal, smelter[4] [5] metric tons	101	133	157	162
Tin:				
Mine output, metal content do.	228,364	235,909	251,183	256,002
Metal, smelter do.	233,622	232,378	244,945	261,631
Titanium concentrates, gross weight:				
Ilmenite[4] [8] thousand metric tons	3,165	3,315	3,504	3,492
Rutile[3] [4] do.	121	363	322	382
Titaniferous slag do.	818	694	941	777
Tungsten, mine output, metal content metric tons	41,270	42,675	45,459	45,105
Uranium oxide, mine output, U_3O_8 content[4] [5] do.	28,400	33,565	40,473	42,043
Vanadium, mine output, metal content do.	28,334	30,152	31,864	37,614
Zinc:				
Mine output, metal content thousand metric tons	5,690	5,906	5,878	5,998
Metal, smelter:				
Primary[6] do.	5,370	5,527	5,614	5,998
Secondary[7] do.	242	224	207	235
Zirconium concentrate[3] [4] [5] do.	448	432	446	544
NONMETALS				
Asbestos do.	5,085	5,221	5,154	5,287
Barite do.	5,247	5,821	6,815	6,978
Boron minerals do.	2,341	2,748	3,075	2,612
Bromine[4] do.	298	289	324	345
Cement, hydraulic do.	745,144	798,812	846,197	885,090

See footnotes at end of table.

Table 1.—World production of major mineral commodities[1] —Continued

Commodity and unit of measure	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Clays:[4]				
Bentonite[5] thousand metric tons	5,012	5,269	5,864	5,940
Fuller's earth[5] do.	1,727	1,638	1,695	1,728
Kaolin do.	16,281	18,002	19,342	20,045
Corundum, natural metric tons	8,566	9,865	9,818	9,892
Diamond:[4]				
Gem thousand carats	9,675	10,358	10,417	10,657
Industrial do.	29,021	28,724	28,536	29,041
Total do.	38,696	39,082	38,953	39,698
Diatomite[4] thousand metric tons	1,725	1,758	1,789	1,764
Feldspar[4] do.	2,806	2,938	3,088	3,098
Fluorspar do.	4,440	4,653	4,797	4,877
Graphite[3] metric tons	458,389	505,383	534,670	523,776
Gypsum thousand metric tons	65,946	70,809	76,156	75,814
Iodine metric tons	10,064	10,636	10,679	11,189
Lime[4] thousand metric tons	89,800	91,408	92,603	94,914
Magnesite[3] do.	9,021	9,673	9,695	10,063
Mica[4] do.	214	226	246	243
Nitrogen, N content of ammonia[10] do.	56,891	62,156	66,060	70,491
Perlite do.	1,271	1,361	1,399	1,420
Phosphate rock and guano do.	107,514	116,568	125,064	126,829
Potash, marketable, K_2O equivalent do.	24,396	25,801	26,000	26,345
Pumice[4 5] do.	15,229	15,713	17,775	17,675
Salt do.	160,097	158,382	157,900	165,743
Sodium compounds, n.e.s.:[4]				
Sodium carbonate do.	25,035	27,226	28,383	28,531
Sodium sulfate do.	4,450	4,219	4,152	4,274
Strontium minerals[4 5] metric tons	68,797	91,837	85,608	78,500
Sulfur, elemental basis:				
Elemental[11] thousand metric tons	17,086	16,449	17,124	17,913
From pyrite do.	9,426	9,413	9,469	9,862
Byproduct[12] do.	24,376	26,231	26,806	27,059
Total do.	50,888	52,093	53,399	54,834
Talc, soapstone, pyrophyllite do.	5,242	5,625	5,833	6,287
Vermiculite[4 5] metric tons	523,149	523,974	559,020	554,059
MINERAL FUELS AND RELATED MATERIALS				
Carbon black[4 5] thousand metric tons	3,666	3,727	4,021	4,141
Coal:				
Anthracite million metric tons	190	211	217	223
Bituminous coal do.	2,309	2,400	2,445	2,613
Lignite do.	889	912	919	941
Total do.	3,388	3,523	3,581	3,777
Coke:[13]				
Metallurgical thousand metric tons	378,106	369,329	365,555	376,788
Other do.	19,015	18,624	13,983	13,863
Gas, natural, marketed billion cubic feet	48,236	49,948	51,789	53,209
Natural gas liquids[4] million 42-gallon barrels	1,043	1,082	1,080	1,177
Peat thousand metric tons	66,577	66,305	67,069	66,633
Petroleum:				
Crude million 42-gallon barrels	21,108	21,882	22,167	22,993
Refined do.	21,358	22,429	22,835	23,461

[e] Estimate. [p] Preliminary.

[1] Incorporates numerous revisions from world production tables and country production tables appearing in volumes I and III, respectively, of the Minerals Yearbook, as well as from the table corresponding to this table in previous editions of this chapter.

[2] Includes bauxite equivalent of nepheline syenite and alunite produced in the U.S.S.R. (the only producer on record of such materials as a source of aluminum).

[3] Excludes data for the United States (withheld to avoid disclosing company proprietary data).

[4] Excludes data for China (no adequate basis for estimation available).

[5] Excludes data for the U.S.S.R. (no adequate basis for estimation available).

[6] Includes all metal clearly identified as primary as well as all metal that cannot be subdivided clearly between primary and secondary (see footnote 7).

[7] Includes only that metal that is clearly identified as secondary. Some countries do not distinguish between primary and secondary and for some of these, no basis is available for estimating the breakdown of total production. For such countries, the total has been included under primary (see footnote 6).

[8] Excludes data for the United States (withheld to avoid disclosing company proprietary data), which in previous years accounted for approximately 50% of the world total.

[9] Includes leucoxene.

[10] Data are for years ending June 30 of that stated.

[11] Comprises sulfur produced by the Frasch process plus sulfur mined in the elemental state from ores.

[12] Comprises sulfur recovered from coal gasification, metallurgical operations (except pyrite processing), natural gas, petroleum, tar sands, spent oxides, and gypsum, whether recovered in the elemental state or as a sulfur compound.

[13] Production of coke other than metallurgical by China and the U.S.S.R. is included with metallurgical coke production.

Table 2.—Value of world export trade in major mineral commodities[1]

(Million U.S. dollars)

Commodity group	1974[r]	1975[r]	1976[r]	1977[r]	1978
Metals:					
All ores, concentrates, scrap	14,980	15,002	16,198	15,788	15,889
Iron and steel	46,445	45,761	44,667	46,755	57,150
Nonferrous metals	24,829	18,462	21,711	24,240	28,770
Subtotal	86,254	79,225	82,576	86,783	101,809
Nonmetals, crude only	5,785	6,191	6,281	6,964	6,702
Mineral fuels	172,924	169,508	199,444	220,777	211,351
Total	264,963	254,924	288,301	314,524	319,862
All commodities	838,268	872,978	990,163	1,123,202	1,290,258

[r] Revised.

[1] Data presented are for selected major commodity groups of the Standard International Trade Classification Revised (SITC-R) and as such exclude some mineral commodities classified in that data array together with other (nonmineral) commodities. SITC-R categories included are as follows: All ores, concentrates, and scrap—SITC Division 28; iron and steel—SITC Division 67; nonferrous metals—SITC Division 68; nonmetals (crude only)—SITC Division 27; and mineral fuels—SITC Division 3. Major items not included are the metals, metalloids, and metal oxides of SITC Group 513; mineral tar and other coal-, petroleum-, and gas-derived crude chemicals of SITC Division 52; manufactured fertilizers of SITC Division 56; and nonmetallic mineral manufactures of SITC Groups 661, 662, 663, and 667. Data include special category exports, ships' stores and bunkers, and other exports of minor importance, and exclude the intertrade of the centrally planned economy countries of Asia and trade between the Federal Republic of Germany and the German Democratic Republic.

Source: United Nations. Monthly Bulletin of Statistics, New York, v. 34, No. 5, May 1980, pp. xxxiv-lvi.

Table 3.—Distribution of value of world export trade in major mineral commodity groups, by commodity group[1]

(Percent)

Commodity group	1974	1975	1976	1977	1978
Metals:					
All ores, concentrates, scrap	[r]5.7	[r]5.9	[r]5.6	[r]5.0	5.0
Iron and steel	17.5	18.0	15.5	14.9	17.8
Nonferrous metals	[r]9.3	7.2	7.5	[r]7.7	9.0
Subtotal	[r]32.5	[r]31.1	[r]28.6	27.6	31.8
Nonmetals, crude only	2.2	2.4	2.2	2.2	2.1
Mineral fuels	[r]65.3	[r]66.5	[r]69.2	70.2	66.1

[r] Revised.

[1] For detailed definition of groups, see footnote 1, table 2.

Table 4.—Growth of value of world export trade in major mineral commodity groups[1]

(Percent change from previous year)

Commodity group	1974	1975	1976	1977	1978
Metals:					
All ores, concentrates, scrap	+36.7	+0.2	+7.8	-2.5	+0.6
Iron and steel	+63.2	-1.5	-2.4	+4.7	+22.2
Nonferrous metals	+43.5	-25.6	+17.6	+11.6	+18.7
All metals	+52.1	-8.1	+4.2	+5.1	+17.3
Nonmetals, crude only	+50.6	+7.0	+1.5	+10.9	-3.8
Mineral fuels	+173.8	-2.0	+17.7	+10.7	-4.3
All major mineral commodity groups	114.2	-3.8	+13.1	+9.1	+1.7
All commodities	46.1	+4.1	+13.4	+13.4	+14.9

[1] For detailed definition of groups, see footnote 1, table 5.

Table 5.—Annual investment expenditure in the steel industry for selected countries

(Million dollars unless otherwise specified)

Country or country group	1976	1977	1978
EEC	[1]3,293	[r]2,360	2,055
EFTA[2]	816	[r]476	375
Other countries:			
Australia	164	140	132
Canada	392	[r]416	384
Japan	3,443	3,824	NA
Spain	420	476	309
Turkey	271	[r]304	387
United States	3,255	[r]2,850	2,538
Total	[3]12,054	[r] [3]10,846	NA

[r] Revised.   NA Not available.

[1] Source reports that values for European Economic Community (EEC) countries are in terms of "million units of account." For the Federal Republic of Germany (included in EEC in this tabulation), the source indicates that for 1976, 823.1 million "units of account" was equivalent to $885.3 million (no conversion rate given for other countries for 1976 and no conversion rate given for any country for 1977, and no further explanation is offered).

[2] European Free Trade Association (EFTA) figures exclude data for Switzerland.

[3] Figures have been totaled as if EEC data were in U.S. dollars, in keeping within totals appearing in a graph in source publication (see footnote 1).

Source: Organization for Economic Cooperation and Development. The Iron and Steel Industry in 1977. Paris, 1979, p. 25; and The Iron and Steel Industry in 1978. Paris, 1980, p. 25.

Table 6.—U.S. direct foreign investment in mineral industries: Value, earnings, and income

(Million dollars)

Area and country	Mining, smelting, refining			Petroleum		
	Value	Income[1]	Interest, dividends, earnings[2]	Value	Income[1]	Interest, dividends, earnings[2]
1976	[r]7,000	929	591	[r]28,408	5,123	4,385
1977	[r]7,073	813	612	[r]31,420	5,481	[r]4,646
1978:						
Canada	3,006	196	125	8,246	983	419
Latin America and other Western Hemisphere:						
Latin American Republics:						
Chile	W	-3	-2	W	W	W
Peru	W	W	W	W	122	123
Venezuela	W	4	4	392	42	37
Other[3]	1,248	51	61	1,756	199	69
Subtotal	1,248	52	63	2,148	363	229
Other Western Hemisphere	399	125	125	1,744	186	134
Total[4]	1,647	177	188	3,892	549	363
Europe:						
EEC:						
Denmark and Ireland	1	-1	([5])	615	-58	-45
United Kingdom	W	-2	-3	6,329	165	222
Other[3] [6]	6	-3	([5])	5,653	621	327
Subtotal	7	-6	-3	12,597	728	504
Other Western Europe	22	-1	([5])	2,525	300	311
Total[4]	29	-6	-3	15,122	1,028	816
Africa:						
South Africa, Republic of	W	14	9	W	W	W
Other	556	W	W	1,856	365	256
Total[7]	556	14	9	1,856	365	256
Near East	W	1	--	-3,701	1,483	1,450
Far East and Pacific:						
Japan	--	--	--	1,694	221	66
Australia	1,296	223	175	907	206	150
New Zealand	W	1	1	W	W	W
Other	W	W	W	3,314	820	752
Total	1,296	224	176	4,915	1,247	968

See footnotes at end of table.

Table 6.—U.S. direct foreign investment in mineral industries: Value, earnings, and income —Continued

(Million dollars)

Area and country	Mining, smelting, refining			Petroleum		
	Value	Income[1]	Interest, dividends, earnings[2]	Value	Income[1]	Interest, dividends, earnings[2]
1978 —Continued						
International and unallocated shipping	--	--	--	2,557	-8	63
Grand total[4]	6,990	616	527	33,710	5,707	4,352
1979:						
Canada	3,151	436	342	9,168	1,654	826
Latin America and other Western Hemisphere:						
Latin American Republics:						
Chile	9	W	W	W	9	4
Peru	812	W	W	646	308	307
Venezuela	W	5	3	431	108	60
Other[3]	471	261	243	1,564	201	72
Subtotal	1,292	266	246	2,641	626	443
Other Western Hemisphere	360	111	111	1,927	746	305
Total[4]	1,652	377	357	4,568	1,372	749
Europe:						
EEC:						
Denmark and Ireland	1	-2	(5)	212	-42	-39
United Kingdom	18	-5	-6	7,236	1,577	716
Other[3 6]	--	-2	(5)	8,117	2,560	642
Subtotal	19	-9	-6	15,565	4,095	1,319
Other Western Europe	25	(5)	(5)	2,990	435	264
Total[4]	44	-9	-6	18,555	4,530	1,583
Africa:						
South Africa, Republic of	W	27	16	W	111	10
Other	589	W	W	2,161	1,181	1,100
Total[7]	589	27	16	2,161	1,292	1,110
Near East	W	2	(5)	W	W	W
Far East and Pacific:						
Japan	--	--	--	2,111	307	131
Australia	1,300	330	223	1,211	W	167
New Zealand	W	2	2	W	W	-8
Other	W	W	W	W	W	W
Total	1,300	332	225	3,322	307	290
International and unallocated shipping	--	--	--	2,502	237	198
Grand total[4]	7,185	1,232	987	41,533	13,222	8,243

[r] Revised. W Withheld (in source publication) to avoid disclosing company proprietary data.

[1] Sum of U.S. share in net earnings of subsidiary and branch profits.

[2] Sum of interest, dividends, and earnings of unincorporated affiliates.

[3] Calculated, by difference between listed detail and reported total.

[4] Detail may not add to totals shown because of independent rounding and exclusion of some data in detail.

[5] Less than 1/2 unit.

[6] Includes Belgium, France, the Federal Republic of Germany, Italy, Luxembourg, and the Netherlands.

[7] Not reported in source; sum of reported detail, and incomplete in some cases, owing to withheld data in detail.

Source: U.S. Department of Commerce. Survey of Current Business. V. 60, No. 8, August 1980, pp. 27-36.

Table 7.—World merchant fleet distribution, by type[1]

	1974	1975	1976	1977	1978
Number of vessels:					
Tankers	5,121	5,311	5,383	5,333	5,233
Bulk carriers	4,075	4,272	4,570	4,932	4,651
Freighters	[2]11,449	12,575	12,923	12,176	14,141
Other	[3]1,804	714	710	655	487
Total	22,449	22,872	23,586	24,096	24,512
Gross tonnage:					
Tankers thousand metric tons	143,399	163,731	179,116	185,405	182,367
Bulk carriers do	82,313	88,194	95,451	103,741	104,291
Freighters do	[2]68,855	75,284	77,939	81,414	87,700
Other do	[3]11,799	5,833	5,697	5,268	4,551
Total do	306,366	333,042	358,203	375,828	378,909
Deadweight tonnage:					
Tankers do	261,440	302,217	335,600	349,976	344,780
Bulk carriers do	139,267	150,080	163,298	178,633	180,436
Freighters do	[2]93,476	101,248	104,639	109,857	117,953
Other do	[3]9,165	3,027	2,962	2,753	2,319
Total do	503,348	556,572	606,499	641,219	645,488

[1] Maritime Administration classification. Tankers include whaling tankers. Vessels shown here as "Other" include combination passenger and cargo and combination passenger and refrigerated cargo. The contribution of these vessels to mineral commodity trade is regarded as unimportant. Data are as of December 31 of year indicated.

[2] Excludes refrigerated freighters.

[3] Includes refrigerated freighters.

Source: U.S. Department of Commerce, Maritime Administration. Merchant Fleets of the World. Annual issues covering 1973 through 1977, and unpublished data supplied for 1978.

Table 8.—World shipping loadings and unloadings[1]

(Million metric tons)

	1974	1975	1976	1977[r]	1978
Loadings:					
Tanker cargo	1,837	1,644	1,803	1,868	1,840
Dry cargo	1,476	1,428	1,588	1,585	1,621
Total	3,313	3,072	3,391	3,453	3,461
Unloadings:					
Tanker cargo	1,784	1,660	1,814	1,869	1,818
Dry cargo	1,477	1,396	1,469	1,531	1,560
Total	3,261	3,056	3,283	3,400	3,378

Source: United Nations. Monthly Bulletin of Statistics, New York. V. 34, No. 1, January 1980, p. xxxv.

Table 9.—World shipping of dry cargo, by geographical area

(Million metric tons)

Area	Loadings			Unloadings		
	1976	1977	1978	1976	1977	1978
Market economy countries:						
Developed:						
Australia and New Zealand	163	[r]172	146	19	20	21
Canada	111	116	113	38	41	45
Japan	76	79	81	335	[r]322	301
South Africa, Republic of	26	30	40	7	[r]11	8
United States	252	[r]249	265	114	[r]137	152
Western Europe	323	[r]315	378	579	[r]568	626
Other	4	[r]4	4	--	[r]1	1
Total	955	[r]965	1,027	1,092	[r]1,100	1,154
Developing:						
Caribbean	24	[r]25	25	12	[r]17	12
Venezuela	22	[r]25	25	7	7	8
Other Latin America	149	[r]145	150	51	[r]57	62
Far East	144	[r]155	180	110	[r]144	121
Near East	46	[r]22	36	44	[r]45	49
Northern Africa	34	[r]29	39	30	[r]37	39
Other Africa	81	66	60	25	32	23
Other	10	[r]17	6	4	[r]6	2
Total	510	[r]484	471	283	[r]345	316
Centrally planned economy countries:						
U.S.S.R	66	[r]69	70	[r]33	26	38
Other	57	[r]67	53	[r]61	60	52
Total	123	136	123	94	86	90

[r] Revised.

Source: United Nations. Monthly Bulletin of Statistics, New York. V. 34, No. 1, January 1980, pp. xxxv-xxxviii.

Table 10.—World shipping of tanker cargo, by geographical area

(Million metric tons)

Area	Loadings			Unloadings		
	1976	1977	1978	1976	1977	1978
Market economy countries:						
Developed:						
Australia and New Zealand	3	[r]3	4	16	16	17
Canada	4	4	4	18	18	17
Japan	--	--	--	241	[r]260	255
South Africa, Republic of	--	--	--	17	[r]16	17
United States	6	[r]1	9	374	[r]431	394
Western Europe	115	[r]138	128	736	[r]732	106
Other	21	21	21	28	[r]24	24
Total	149	[r]167	166	1,430	[r]1,497	1,430
Developing:						
Caribbean	56	[r]48	72	101	[r]93	94
Venezuela	109	[r]103	100	--	--	--
Other Latin America	19	[r]21	27	68	[r]67	65
Far East	93	[r]111	109	117	[r]111	130
Near East	1,023	[r]1,033	989	24	[r]27	24
Northern Africa	145	[r]160	158	16	[r]11	11
Other Africa	119	[r]124	110	[r]17	[r]16	14
Other	--	--	1	[r]1	[r]5	2
Total	1,564	[r]1,600	1,566	344	[r]330	340
Centrally planned economy countries:						
U.S.S.R	78	[r]85	88	8	7	8
Other	[r]12	[r]16	20	[r]32	[r]35	40
Total	[r]90	[r]101	108	[r]40	[r]42	48

[r] Revised.

Source: United Nations. Monthly Bulletin of Statistics, New York. V. 34, No. 1, January 1980, pp. xxxv-xxxviii.

Table 11.—Nonferrous metal prices in the United States

(Average, cents per pound unless otherwise specified)

Year and month	Aluminum[1]	Copper[2]	Lead[3]	Zinc[4]	Tin[5]	Silver[6]
1976	44.341	68.824	23.102	37.010	349.241	435.346
1977	51.339	65.804	30.703	34.386	499.381	462.302
1978:						
January	53.000	62.625	33.000	30.500	549.000	493.395
February	53.000	62.593	33.000	30.063	549.833	493.563
March	53.000	61.410	33.000	29.000	518.478	527.286
April	53.000	63.625	33.000	29.000	499.188	511.840
May	53.000	63.768	31.000	29.000	531.591	512.068
June	52.000	65.569	31.000	29.012	555.227	531.586
July	53.000	63.079	31.000	29.800	563.350	533.065
August	53.000	66.232	32.168	31.156	592.087	549.496
September	53.000	66.632	34.059	32.373	633.500	557.480
October	53.000	69.495	36.610	32.829	710.333	591.791
November	53.000	70.191	38.000	34.425	693.050	586.645
December	53.900	70.897	38.000	34.498	644.450	592.850
Average	53.075	65.510	33.653	30.971	586.674	540.089
1979:						
January	55.000	75.574	40.760	34.574	643.273	625.455
February	55.000	88.697	43.632	35.617	685.222	741.716
March	55.341	95.718	45.749	37.241	713.864	744.518
April	58.000	97.322	48.000	38.993	691.619	749.250
May	58.000	90.234	48.805	39.387	695.000	837.346
June	58.000	87.241	56.510	39.387	707.857	853.833
July	58.000	85.768	58.066	39.387	708.333	913.505
August	58.000	90.335	57.913	36.902	687.391	933.387
September	60.079	94.853	58.004	35.797	721.632	1,395.916
October	65.318	98.106	61.057	36.206	749.773	1,678.073
November	66.000	98.708	57.262	36.823	766.316	1,660.265
December	66.000	105.448	55.947	37.233	788.750	2,179.278
Average	59.395	92.334	52.642	37.296	713.253	1,109.379

[1] Unalloyed ingot, 99.5%, delivered United States.
[2] Electrolytic copper, domestic refineries, on Atlantic seaboard.
[3] Refined lead, nationwide.
[4] Prime Western slab, f.o.b. East St. Louis.
[5] Straits tin, New York.
[6] Cents per troy ounce, 999 fine, New York.

Table 12.—Nonferrous metal prices in the United Kingdom[1]

(Average, U.S. cents per pound unless otherwise specified)

Year and month	Aluminum[2]	Copper[3]	Lead[4]	Zinc	Tin[5]	Silver[6]
1976	40.400	64.051	20.502	32.304	349.123	434.922
1977	51.890	59.380	28.002	26.733	489.539	463.310
1978:						
January	59.690	57.191	30.033	23.469	549.192	494.521
February	59.830	55.188	26.423	21.620	551.284	496.105
March	58.770	56.862	26.345	23.005	518.947	525.157
April	57.050	58.286	25.957	25.115	498.897	515.283
May	56.080	59.072	24.652	25.432	532.102	514.305
June	56.670	60.444	25.839	26.169	562.789	533.174
July	58.450	60.652	26.390	26.448	564.107	535.241
August	59.860	64.685	28.964	28.007	590.231	553.737
September	62.570	65.419	31.410	28.727	630.742	559.605
October	64.650	68.331	37.632	32.262	691.032	594.688
November	63.150	66.665	36.474	31.149	684.478	587.208
December	63.960	69.551	38.929	31.136	644.011	593.571
Average	60.060	61.826	29.803	26.870	583.912	541.883
1979:						
January	57.376	75.264	44.967	32.641	630.544	621.001
February	65.405	88.191	47.791	35.921	665.883	734.710
March	69.932	92.973	53.318	36.004	684.403	741.622
April	71.184	95.237	52.601	35.739	688.356	745.084
May	71.553	87.373	56.158	35.275	697.400	839.377
June	72.484	85.181	62.627	34.133	732.639	855.900
July	69.594	82.283	57.644	32.794	716.438	915.618
August	70.804	89.650	54.962	30.124	671.588	930.830
September	73.266	95.067	55.771	32.794	698.845	1,377.149
October	80.897	94.145	59.768	31.998	727.861	1,666.249
November	83.347	94.805	55.492	31.764	743.221	1,666.121
December	86.843	100.427	53.334	33.977	771.154	2,237.919
Average	72.724	90.113	54.520	33.588	702.678	1,110.965

[1] London Metal Exchange, average settlement prices.
[2] Ingot, 99.5%.
[3] Electrolytic wirebar.
[4] Refined pig lead, 99.97%.
[5] Standard tin.
[6] U.S. cents per troy ounce, 999 fine.

Table 13.—Nonferrous metal prices in Canada

(Average, U.S. cents per pound unless otherwise specified)

Year and month	Copper[1]	Lead[2]	Zinc[2]	Silver[3]
1976	69.578	22.945	37.368	435.703
1977	65.999	29.536	32.996	461.214
1978:				
January	63.340	32.011	29.513	493.788
February	67.670	31.672	28.999	493.943
March	61.399	31.310	27.535	527.705
April	63.672	30.876	27.154	512.299
May	65.372	30.781	27.713	512.445
June	66.583	30.531	29.215	531.991
July	64.092	30.455	30.233	533.966
August	66.089	30.997	30.215	549.685
September	66.154	31.552	30.652	557.908
October	69.910	34.986	32.057	592.152
November	75.846	35.802	33.245	587.699
December	71.388	35.600	33.058	593.082
Average	66.376	32.213	29.966	540.555
1979:				
January	74.895	39.190	33.082	625.930
February	86.729	41.320	35.463	742.058
March	98.717	44.680	37.018	744.941
April	100.691	47.540	39.256	749.728
May	91.639	47.990	38.940	837.633
June	88.971	52.640	38.383	854.219
July	86.387	56.710	38.664	916.650
August	90.257	56.380	36.306	936.292
September	93.616	56.860	35.748	1,396.262
October	98.419	60.410	36.586	1,678.487
November	98.794	55.100	36.452	1,662.101
December	105.498	54.770	37.753	2,159.334
Average	92.884	51.130	36.888	1,108.636

[1] Electrolytic wirebar, f.o.b. delivered Canadian points.
[2] Pig lead, Prime Western zinc; producer's prices, carload quantities, communicated by Cominco, Ltd.
[3] U.S. cents per troy ounce, average price of Cominco, Ltd.

Table 14.—Leading world producers of bauxite

(Gross weight, thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
Australia	24,08[illegible]	26,086	24,293	[1]27,583
Guinea[e]	11,316	11,300	12,000	12,500
Jamaica	[r]10,312	11,433	11,736	[1]11,574
U.S.S.R.[e] [2]	[r]6,025	[r]6,180	6,180	6,180
Surinam	[r]4,587	4,856	5,025	5,000
Yugoslavia	2,033	2,044	2,566	[1]3,012
Hungary	2,918	2,949	2,899	3,000
Greece	2,551	2,984	2,630	[1]2,915
Guyana[e]	2,686	2,731	2,400	2,400
Brazil	827	1,120	1,160	2,400
France	2,330	2,059	1,990	2,000
United States	[r]1,989	2,013	1,669	[1]1,821
India	1,448	1,511	1,653	1,600
China, mainland	1,000	1,200	1,400	1,500
Total[2]	74,106	78,466	77,601	83,485
All others	4,882	5,523	5,008	4,909
Grand total[2]	78,988	83,989	82,609	88,394

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Reported figure.
[2] Includes bauxite equivalent of nepheline syenite concentrates and alunite ore (produced in the U.S.S.R. only).

Table 15.—Leading world producers of aluminum

(Thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
United States	[r]3,856	4,118	3,706	[1]4,556
U.S.S.R.[e]	1,600	1,640	1,670	1,720
Japan	919	1,188	1,057	[1]1,010
Canada	633	974	1,048	[1]848
Germany, Federal Republic of	697	742	740	[1]742
Norway	[r]618	628	640	[1]673
France	385	400	391	[1]395
United Kingdom	335	350	346	[1]359
China, mainland[e]	200	250	300	330
Australia	232	248	263	[1]270
Italy	206	260	268	[1]269
Spain	211	211	212	[1]260
Netherlands	256	241	261	[1]256
Brazil	139	167	186	[1]240
Romania	207	209	213	215
India	210	179	214	[1]212
Venezuela	46	43	75	[1]209
Total	[r]10,750	11,848	11,590	12,564
All others	[r]1,779	1,828	1,847	1,943
Grand total	[r]12,529	13,676	13,437	14,507

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Reported figure.

Table 16.—Leading world producers of chromite

(Gross weight, thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
South Africa, Republic of	2,409	3,059	3,145	[1]3,297
U.S.S.R.[e]	[r]2,120	2,180	2,300	2,400
Albania[e]	830	880	990	1,100
Philippines	[r]431	538	537	562
Rhodesia, Southern	864	677	478	[1]542
Turkey[e]	[r]580	[r]508	375	450
Brazil	186	310	270	331
India	402	352	266	272
Finland	[r]175	169	178	190
Total	[r]7,997	8,673	8,539	9,144
All others	[r]539	555	486	436
Grand total	[r]8,536	9,228	9,025	9,580

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Reported figure.

Table 17.—Leading world producers of mine copper

(Cu content of ore, thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
United States[1]	1,457	1,364	1,358	[2]1,444
Chile	1,005	1,056	1,036	[2]1,061
U.S.S.R.[e] [1]	800	830	865	885
Canada[1]	731	739	659	[2]644
Zambia	709	656	643	600
Peru	220	341	367	400
Zaire	444	482	424	377
Poland	267	289	321	325
Philippines	[r]238	273	264	[2]298
Australia	218	222	207	234
South Africa, Republic of	197	208	209	[2]191
Papua New Guinea	176	182	199	[2]171
China, mainland[e]	100	100	150	150
Total	[r]6,562	6,762	6,702	6,780
All others	[r]889	899	855	827
Grand total	[r]7,451	7,661	7,557	7,607

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Recoverable.
[2] Reported figure.

Table 18.—Leading world producers of gold

(Thousand troy ounces)

Country	1976	1977	1978[p]	1979[e]
South Africa, Republic of	22,936	22,502	22,649	[1]22,617
U.S.S.R.[e]	7,700	7,850	8,000	8,160
Canada	1,692	1,734	1,735	[1]1,581
United States	1,048	1,100	999	[1]876
Papua New Guinea	[r]668	740	751	700
Australia	[r]503	630	648	[1]588
Philippines	501	558	587	[1]547
Ghana	532	481	402	[1]482
Rhodesia, Southern	[r]387	402	399	386
Total	[r]35,967	35,997	36,170	35,937
All others	[r]3,054	2,926	2,893	2,943
Grand total	[r]39,021	38,923	39,063	38,880

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Reported figure.

Table 19.—Leading world producers of iron ore, iron ore concentrates, and iron ore agglomerates

(Thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
U.S.S.R	239,109	239,716	244,231	242,000
Australia	93,225	95,923	83,134	[1]89,000
Brazil	94,087	82,001	84,985	87,400
United States	81,277	56,646	82,892	[1]87,092
China, mainland[e]	[r]45,000	[r]50,000	70,000	75,000
Canada	[r]56,933	55,397	43,601	[1]61,273
India	[r]43,868	42,598	38,155	45,700
France	45,181	36,630	33,458	[1]31,668
South Africa, Republic of	15,663	26,481	24,206	[1]31,565
Sweden	29,862	24,839	21,486	[1]26,616
Liberia	18,814	18,136	[e]18,800	20,300
Venezuela	18,685	13,683	13,600	16,300
Korea, North[e]	9,500	[r]9,700	10,000	10,000
Spain	8,227	8,327	8,935	9,220
Chile	10,055	7,896	9,666	8,600
Mauritania	9,664	9,794	6,934	8,000
Total	[r]819,150	777,767	794,083	849,734
All others	[r]63,795	63,080	60,435	59,895
Grand total	[r]882,945	840,847	854,508	909,629

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Reported figure.

Table 20.—Leading world producers of crude steel[1]

(Thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
U.S.S.R	[r]144,825	146,678	151,436	[2]149,000
United States	116,120	113,700	124,312	[2]123,687
Japan	107,399	102,405	102,105	[2]111,748
Germany, Federal Republic of	42,415	38,985	41,253	[2]46,044
China, mainland	[r, e]20,000	23,740	31,780	[2]34,430
Italy	23,447	23,334	24,283	[2]24,250
France	23,221	22,094	22,841	[2]23,264
United Kingdom	[r]22,274	20,411	20,311	[2]21,408
Poland	[r]15,639	17,841	19,251	[2]19,224
Canada	[r]13,290	13,631	14,898	[2]16,078
Czechoslovakia	14,693	15,064	15,294	[2]14,800
Brazil	9,169	11,164	12,107	[2]13,893
Belgium	[r]12,145	11,256	12,601	[2]13,442
Romania	10,783	11,457	11,779	12,500
Spain	[r]11,002	11,102	11,645	[2]12,248
India	9,255	9,918	9,987	9,465
South Africa, Republic of	7,156	7,379	7,800	[2]8,816
Australia	7,774	7,313	7,589	[2]8,126
Total	[r]610,557	607,472	641,272	662,423
All others	[r]52,752	62,999	69,376	75,984
Grand total	[r]663,309	670,471	710,648	738,407

[e]Estimate. [p]Preliminary. [r]Revised.

[1] Steel ingots and castings.

[2] Reported figure.

Table 21.—Leading world producers of mine lead

(Pb content of ore, thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
United States[1]	553	537	530	[2]526
U.S.S.R.[e]	500	510	520	525
Australia	[r]397	432	400	[2]416
Canada	256	281	320	[2]316
Peru[1]	160	166	183	[2]185
Mexico[1]	200	163	171	180
Yugoslavia	122	130	124	[2]128
China, mainland[e]	[r]90	100	120	120
Bulgaria[e]	[r]110	117	[e]117	117
Morocco	60	93	100	110
Korea, North[e]	[r]110	110	105	105
Total	[r]2,558	2,639	2,690	2,728
All others	[r]745	767	755	785
Grand total	[r]3,303	3,406	3,445	3,513

[e]Estimate. [p]Preliminary. [r]Revised.

[1] Recoverable.

[2] Reported figure.

Table 22.—Leading world producers of manganese ore

(Gross weight, thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
U.S.S.R	8,636	8,595	9,057	[1]9,500
South Africa, Republic of	5,452	5,048	4,317	[1]5,182
Gabon	2,217	1,851	1,661	1,800
Brazil	1,696	1,516	[e]1,650	1,700
Australia	2,154	1,389	1,290	[1]1,666
India	[r]1,835	1,865	1,567	1,680
China, mainland[e]	1,000	1,000	1,300	1,500
Mexico	453	487	523	544
Ghana	312	292	316	272
Hungary	[r]125	120	114	105
Total	[r]23,880	22,163	21,795	23,899
All others	[r]772	662	587	519
Grand total	[r]24,652	22,825	22,382	24,418

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Reported figure.

Table 23.—Leading world producers of mine nickel

(Thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
U.S.S.R.[e]	[r]135	142	148	152
Canada	241	233	128	[1]132
New Caledonia	[r]110	105	66	[1]81
Australia	83	86	82	[1]74
Cuba[e]	37	37	37	37
Philippines	[e]16	37	31	38
Indonesia	29	33	32	36
Dominican Republic	24	25	14	[1]25
Total	[r]675	698	538	573
All others	[r]125	123	126	129
Grand total	[r]800	821	664	702

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Reported figure.

Table 24.—Leading world producers of mine tin

(Sn content of ore, metric tons)

Country	1976	1977	1978[p]	1979[e]
Malaysia	63,401	58,703	62,650	64,000
Thailand	20,452	24,205	31,423	[1]35,353
U.S.S.R.[e]	31,000	33,000	34,000	35,000
Bolivia	[r]30,315	32,616	30,883	[1]27,648
Indonesia	[r]24,456	25,926	27,437	26,000
China, mainland[e]	20,000	20,000	22,000	25,000
Australia	[r]10,611	10,634	11,864	[1]11,400
Brazil	5,388	6,450	6,980	8,000
Zaire	[r]3,776	5,073	4,390	4,500
Nigeria	3,710	3,267	2,751	3,000
Total	[r]213,109	219,874	234,378	239,901
All others	[r]15,255	16,035	16,805	16,101
Grand total	[r]228,364	235,909	251,183	256,002

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Reported figure.

Table 25.—Leading world producers of mine zinc

(Zn content of ore, thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
Canada	[r]982	1,070	1,067	[1]1,149
U.S.S.R.[e]	720	735	770	770
Australia	468	492	473	[1]530
Peru	[r]421	405	458	[1]490
United States	440	408	303	267
Japan	260	276	275	[1]243
Mexico	259	265	245	240
Ireland	63	116	176	212
Poland[e]	180	188	194	190
Sweden	128	140	163	[1]164
Korea, North[e]	150	150	140	140
Spain	[r]84	98	144	[1]136
China, mainland[e]	100	100	120	120
Yugoslavia	107	112	97	[1]112
Germany, Federal Republic of	[r]111	111	97	[1]97
Bulgaria	86	87	88	89
Greenland	81	77	82	87
Total	[r]4,640	4,830	4,892	5,036
All others	[r]1,050	1,076	986	962
Grand total	[r]5,690	5,906	5,878	5,998

[e] Estimate. [p] Preliminary. [r] Revised.

[1] Reported figure.

Table 26.—Leading world producers of hydraulic cement

(Thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
U.S.S.R	124,246	127,056	126,956	[1]123,012
Japan	68,712	73,138	84,868	[1]87,804
United States	[r]67,580	72,627	77,546	[1]77,931
China, mainland	[r]40,000	53,750	65,240	[1]73,900
Italy	36,327	37,721	37,758	40,140
Germany, Federal Republic of	[r]33,281	32,163	33,959	[1]35,472
France	29,394	28,830	28,025	[1]28,824
Spain (including Canary Islands)	25,202	27,995	30,233	[1]27,912
Brazil	19,147	21,123	22,100	[1]24,300
Poland	19,800	21,300	21,700	[1]19,176
India	[r]18,640	19,060	19,560	[1]18,264
Korea, Republic of	11,873	14,196	15,133	[1]16,423
United Kingdom	15,780	15,456	15,916	[1]16,140
Romania	[r]13,088	13,875	14,688	[1]15,600
Mexico	12,584	13,227	14,056	[1]15,050
Turkey	[r]12,342	13,833	15,129	[1]13,788
German Democratic Republic	11,344	12,102	12,521	13,000
Total	[r]559,340	597,452	635,388	646,736
All others	[r]185,804	201,360	210,809	238,354
Grand total	[r]745,144	798,812	846,197	885,090

[e] Estimate. [p] Preliminary. [r] Revised.

[1] Reported figure.

Table 27.—Leading world producers of diamond[1]

(Thousand carats)

Country	1976	1977	1978[p]	1979[e]
Zaire	11,821	11,213	11,250	11,160
U.S.S.R.[e]	9,900	10,300	10,550	10,700
South Africa, Republic of	7,023	7,643	7,727	7,640
Botswana	2,384	2,691	2,785	3,340
South-West Africa, Territory of	1,694	2,001	1,898	1,950
Ghana	2,283	1,947	1,423	1,500
Total	35,105	35,795	35,633	36,290
All others	[r]3,591	3,287	3,320	3,408
Grand total	[r]38,696	39,082	38,953	39,698

[e] Estimate. [p] Preliminary. [r] Revised.

[1] Gem and industrial grades undifferentiated.

Table 28.—Leading world producers of nitrogen fertilizer compounds

(N content, thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
United States	12,570	13,347	12,911	[1]13,546
U.S.S.R	10,090	10,744	11,300	12,200
China, mainland[e]	4,070	5,620	6,750	7,170
India[2]	1,910	2,037	2,220	2,900
Romania	1,659	1,792	2,257	2,360
Netherlands	1,980	2,140	2,166	2,200
Japan	2,236	2,292	2,454	2,190
Germany, Federal Republic of	1,863	1,989	1,955	2,090
France	1,781	2,034	2,016	2,090
Canada	1,258	1,764	1,926	[1]1,981
United Kingdom	1,348	1,631	1,600	1,630
Poland	1,726	1,665	1,610	1,630
Italy	1,219	1,168	1,444	1,465
Mexico	716	780	1,304	1,360
German Democratic Republic	1,119	1,130	1,137	1,200
Total	45,545	50,133	53,050	56,012
All others	11,346	12,023	13,010	14,479
Grand total	56,891	62,156	66,060	70,491

[e]Estimate. [p]Preliminary.

[1]Reported figure.

[2]Data given are for years beginning April 1 of that stated.

Table 29.—Leading world producers of phosphate rock[1]

(Thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
United States	[r]44,671	47,256	50,037	51,000
U.S.S.R.[e] [2]	[r]23,900	24,250	23,800	23,800
Morocco[3]	15,829	17,984	19,713	20,000
China, mainland[e]	[r]4,000	4,000	4,500	5,000
Tunisia	[r]3,301	3,615	3,712	3,800
South Africa, Republic of	1,731	2,403	2,699	3,100
Togo	2,008	2,857	2,827	2,900
Jordan	1,717	1,782	2,303	2,560
Total	[r]97,157	104,147	109,591	112,160
All others	[r]10,357	12,421	15,473	14,669
Grand total	[r]107,514	116,568	125,064	126,829

[e]Estimate. [p]Preliminary. [r]Revised.

[1]Includes output of all major crude mineral sources of phosphate.

[2]Includes material described as sedimentary rock in Soviet sources.

[3]Includes output from Western Sahara.

Table 30.—Leading world producers of marketable potash

(K_2O equivalent, thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
U.S.S.R	8,310	8,347	8,193	7,500
Canada	4,996	6,089	6,124	6,600
German Democratic Republic	3,161	3,229	3,323	3,400
Germany, Federal Republic of	2,036	2,341	2,470	2,600
United States	2,177	2,229	2,253	[1]2,225
France	[r]1,603	1,580	1,795	1,850
Total	[r]22,283	23,815	24,158	24,175
All others	[r]2,103	1,986	1,842	2,170
Grand total	[r]24,386	25,801	26,000	26,345

[e]Estimate. [p]Preliminary. [r]Revised.

[1]Reported figure.

Table 31.—Leading world producers of salt

(Thousand metric tons)

Country	1976	1977	1978[p]	1979[e]
United States (including Puerto Rico)	40,114	39,407	38,915	[1]39,124
China, mainland[e]	[r] [e]20,000	[r] [e]17,000	19,537	20,000
U.S.S.R.[e]	[r]14,200	[r]14,300	14,500	14,700
Germany, Federal Republic of	[r]11,317	12,322	12,658	12,700
United Kingdom	8,006	8,202	7,310	7,350
France	[r]6,078	5,350	6,525	6,880
Canada	5,994	6,039	6,452	[1]6,672
Mexico	4,591	4,900	5,635	5,600
Italy	4,013	5,030	4,932	5,100
Romania	4,210	4,536	4,739	4,800
India	[r]4,438	3,759	4,380	4,540
Poland	3,818	4,357	4,393	4,500
Australia	5,489	4,715	4,665	4,500
Netherlands	3,026	3,111	2,939	2,900
Brazil	2,473	2,481	2,727	2,800
German Democratic Republic	2,560	2,643	2,741	2,753
Spain	3,158	2,434	2,500	2,660
Bahamas	1,353	1,670	1,633	1,360
Japan	1,021	1,056	1,073	1,100
Argentina	[r]660	1,147	961	999
Turkey	579	777	929	900
Egypt	480	597	755	760
Colombia	[r]1,112	922	751	744
Total	[r]148,690	146,755	151,650	153,442
All others	[r]11,407	11,627	6,250	12,301
Grand total	[r]160,097	158,382	157,900	165,743

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Reported figure.

Table 32.—Leading world producers of elemental sulfur[1]

(Thousand metric tons)

Country	1976				1977				1978[p]				1979[e]			
	Native	From pyrite	Byproduct	Total	Native	From pyrite	Byproduct	Total	Native	From pyrite	Byproduct	Total	Native	From pyrite	Byproduct	Total
United States	[2]6,365	[r]290	4,223	10,878	[2]5,916	169	4,642	10,727	[2]5,648	301	5,226	11,175	[2]6,357	400	5,344	12,101
U.S.S.R.[e]	[3]2,700	3,300	3,140	9,140	[3]2,900	3,500	3,340	9,740	[3]3,500	3,500	3,550	10,550	[3]3,500	3,500	3,550	10,550
Canada	--	[r]15	7,246	[r]7,261	--	12	7,501	7,513	--	5	7,242	7,247	--	16	6,953	6,969
Poland	[3]4,891	--	319	[r]5,210	[3]4,765	--	325	5,090	[3]4,771	--	379	5,150	[3]5,051	--	370	5,421
Japan	--	[r]471	2,177	[r]2,648	--	389	2,436	2,825	--	327	2,400	2,727	--	330	2,450	2,780
Mexico	[3]2,054	--	171	2,225	[3]1,723	--	213	1,936	[3]1,818	--	236	2,053	[3]1,960	--	430	2,390
France	--	--	1,968	1,968	--	--	2,160	2,160	--	--	2,220	2,220	--	--	2,250	2,250
China, mainland[e]	[r]150	900	[r]300	[r]1,350	[r]170	[r]1,000	[r]300	1,470	200	1,100	350	1,650	200	1,200	400	1,800
Germany, Federal Republic of	--	233	1,130	1,363	--	235	1,367	1,602	--	221	1,380	1,601	--	260	1,380	1,640
Spain	--	[r]1,052	128	[r]1,180	--	1,102	136	1,238	--	1,071	130	1,201	--	1,160	133	1,293
Iraq	[r] [3]582	--	[r]40	[r]622	[3]620	--	[r] [e]40	[r]660	[3]600	--	40	640	[3]660	--	40	700
Italy	35	[r]366	211	[r]612	36	371	259	666	16	330	250	596	16	330	250	596
Romania	--	375	98	473	--	395	110	505	--	400	120	520	--	425	130	555
South Africa, Republic of	--	294	118	412	--	332	133	465	--	340	125	465	--	340	125	465
Bulgaria	--	280	60	340	--	305	65	370	--	310	70	380	--	315	75	390
Sweden	--	205	[r]168	[r]373	--	204	165	369	--	233	148	381	--	240	150	390
Finland	--	234	[r]308	[r]542	--	130	305	435	--	87	262	349	--	85	300	385
German Democratic Republic	--	10	[r]329	[r]339	--	10	340	350	--	10	350	360	--	10	350	360
Yugoslavia	--	185	205	390	--	166	205	371	--	120	207	327	--	120	207	327
Iran	[r]188	--	399	[r]587	188	--	400	588	150	--	300	450	75	--	200	275
Belgium	--	--	[r]218	[r]218	--	--	257	257	--	--	267	267	--	--	270	270
Korea, North	--	245	20	265	--	250	12	262	--	255	10	265	--	255	10	265
Australia	--	108	[r]137	[r]245	--	108	132	240	--	67	151	218	--	70	151	221
Total	[r]16,965	[r]8,563	[r]23,113	[r]48,641	16,318	8,678	24,843	49,839	16,703	8,677	25,412	50,792	17,819	9,056	25,518	52,393

See footnotes at end of table.

Table 32.—Leading world producers of elemental sulfur[1] —Continued

(Thousand metric tons)

Country	1976				1977				1978^{p}				1979^{e}			
	Native	From pyrite	Byproduct	Total	Native	From pyrite	Byproduct	Total	Native	From pyrite	Byproduct	Total	Native	From pyrite	Byproduct	Total
All others	^{r}121	^{r}863	^{r}1,263	^{r}2,247	131	735	1,388	2,254	421	792	1,394	2,607	94	806	1,541	2,441
Grand total	^{r}17,086	^{r}9,426	^{r}24,376	^{r}50,888	16,449	9,413	26,231	52,093	17,124	9,469	26,806	53,399	17,913	9,862	27,059	54,834

^{e}Estimate. ^{p}Preliminary. ^{r}Revised.

[1] Includes all recorded production of sulfur, regardless of the form in which it is recovered. Thus, it includes elemental sulfur, whether mined by conventional methods or by the Frasch process, as well as (1) elemental sulfur and the S content of compounds such as H_2S, SO_2, and H_2SO_4 recovered as a principal product of pyrite mining and as a byproduct of the recovery of crude oil and natural gas and as a byproduct of petroleum refining, coal treatment, and metal smelting and/or refining; and (2) sulfur recovered from tar sands, spent oxides, and other miscellaneous sources.

[2] Entirely Frasch-process sulfur.

[3] Includes Frasch-process sulfur as follows, in thousand metric tons: Poland: 1976—4,341; 1977—4,321; 1978—4,546; and 1979—4,500; the U.S.S.R. (estimated): 1976—500; 1977—500; 1978—800; and 1979—800; and total of individually listed countries and grand total: 1976—13,842; 1977—13,080; 1978-13,412; and 1979-14,277. The balance is mined elemental sulfur.

Table 33.—Leading world producers of coal (all grades)

(Million metric tons)

Country	1976			1977			1978[p]			1979[e]		
	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total
U.S.S.R	164	548	712	167	555	722	167	557	724	[1]167	[1]552	[1]719
United States	23	598	621	27	604	631	33	564	597	[1]38	[1]671	[1]709
China, mainland	(2)	480	480	(2)	550	550	(2)	618	618	(2)	[1]663	[1]663
German Democratic Republic	247	(3)	247	254	(3)	254	253	(3)	253	255	--	255
Poland	39	179	218	41	186	227	41	193	234	[1]38	[1]201	[1]239
Germany, Federal Republic of	134	89	223	123	85	208	124	84	208	[1]131	[1]86	[1]217
Czechoslovakia	[r]90	28	[r]118	94	27	121	96	28	124	[1]96	[1]28	[1]124
United Kingdom	[r]2	[r]122	124	1	121	122	2	122	124	2	121	123
Australia	31	75	106	29	78	107	33	80	113	[1]33	[1]83	[1]116
India	4	101	105	4	100	104	4	102	106	[1]3	[1]103	[1]106
South Africa, Republic of	--	77	77	--	85	85	--	90	90	--	[1]104	[1]104
Korea, North[e]	(2)	41	41	(2)	43	43	(2)	44	44	(2)	44	44
Yugoslavia	36	1	37	39	1	40	39	(3)	39	[1]42	[1](3)	[1]42
Canada	5	21	26	5	23	28	5	25	30	[1]5	[1]28	[1]33
Romania	[r]19	7	[r]26	20	7	27	22	7	29	[1]23	[1]8	[1]31
Bulgaria	25	(3)	25	25	(3)	25	26	(3)	26	28	(3)	28
Hungary	22	3	25	23	3	26	23	3	26	23	3	26
Greece	22	--	22	24	--	24	22	--	22	22	--	22
France	3	22	25	3	21	24	3	20	23	2	19	21
Total	[r]866	[r]2,392	[r]3,258	879	2,489	3,368	893	2,537	3,430	908	2,714	3,622
All others	[r]23	[r]107	[r]130	33	122	155	26	125	151	33	122	155
Grand total	[r]889	[r]2,499	[r]3,388	912	2,611	3,523	919	2,662	3,581	941	2,836	3,777

[e]Estimate. [p]Preliminary. [r]Revised.

[1] Reported figure.

[2] Output small, included under "Bituminous and anthracite."

[3] Less than 1/2 unit.

Table 34.—Leading world producers of marketed natural gas[1]

(Billion cubic feet)

Country	1976	1977	1978[p]	1979[e]
United States	19,952	20,025	19,974	[2]20,373
U.S.S.R	11,334	12,219	13,137	13,600
Netherlands	3,436	3,422	3,133	[2]3,292
Canada	3,097	3,231	3,128	3,271
United Kingdom	1,316	1,416	1,382	[2]1,410
Romania	1,136	1,104	1,112	1,034
Mexico	578	600	745	[2]915
Algeria	351	305	490	725
Germany, Federal Republic of	658	638	707	[2]719
Venezuela	[r]480	524	520	[2]576
Libya	487	556	562	570
China, mainland	[r] [e]350	[r] [e]425	486	[2]512
Iran	794	795	687	500
Italy	[r]552	485	485	[2]476
Saudi Arabia	138	159	335	400
Brunei	299	314	308	310
German Democratic Republic	305	300	302	302
Australia	209	217	258	[2]300
Argentina	[r]272	275	260	[2]284
Total	[r]45,744	47,010	48,011	49,569
All others	[r]2,492	2,938	3,778	3,640
Grand total	[r]48,236	49,948	51,789	53,209

[e] Estimate. [p] Preliminary. [r] Revised.

[1] Comprises all gas collected and utilized as a fuel or as a chemical industry raw material as well as that used for gas lift in fields, including gas used in oilfields and/or gasfields as a fuel by producers, even though it is not actually sold. Excludes gas produced and subsequently vented, flared, or reinjected to reservoirs.

[2] Reported figure.

Table 35.—Leading world producers of natural gas liquids[1]

(Million 42-gallon barrels)

Country[2]	1976	1977	1978[p]	1979[e]
United States	587	590	572	[3]611
U.S.S.R.[e]	100	110	110	120
Canada	[r]106	106	98	[3]102
Saudi Arabia	66	70	91	100
Algeria	24	[e]25	[e]32	55
Mexico	34	38	44	52
Venezuela	[r]29	29	22	25
Total	[r]946	968	969	1,065
All others	[r]97	114	111	112
Grand total	[r]1,043	1,082	1,080	1,177

[e] Estimate. [p] Preliminary. [r] Revised.

[1] Every effort has been made to include only those natural gas liquids produced by natural gas processing plants and to exclude natural gas liquids obtained from field treatment facilities including wellhead separators, because the latter are normally blended with crude oil and thus are included in crude oil output statistics. In some cases, however, sources do not clearly specify whether data presented represent only output of natural gas processing plants or if they include field output. Thus, some of the figures may include field condensate.

[2] In addition to the countries listed, mainland China may also produce natural gas liquids, but available information is inadequate to make reliable estimates of output levels.

[3] Reported figure.

Table 36.—Leading world producers of crude oil

(Million 42-gallon barrels)

Country	1976	1977	1978[p]	1979[e]
U.S.S.R	[r]3,820	4,011	4,201	[1]4,307
Saudi Arabia[2]	[r]3,140	3,358	3,030	3,350
United States	2,976	3,009	3,178	[1]3,114
Iraq	[r]882	857	935	1,250
Iran	[r]2,147	2,067	1,913	1,110
Kuwait[2]	[r]786	719	777	[1]913
Venezuela	840	817	790	[1]859
Nigeria	756	761	697	[1]841
China, mainland[e]	[r]657	684	760	775
Libya	[r]707	753	721	751
United Arab Emirates	[r]709	730	768	741
Indonesia	550	615	597	[1]601
United Kingdom	[r]85	279	389	[1]561
Canada	489	482	478	[1]545
Mexico	[r]267	358	441	[1]533
Algeria	384	410	424	425
Norway	102	102	127	280
Egypt	120	151	176	190
Qatar	182	162	177	[1]185
Argentina	146	158	165	[1]173
Australia	153	157	158	[1]161
Oman	134	124	115	106
Malaysia	61	67	79	103
India	65	76	93	99
Romania	110	109	103	92
Ecuador	68	67	74	86
Brunei	74	77	77	84
Trinidad and Tobago	78	84	84	75
Gabon	82	81	76	[1]71
Peru	28	33	55	70
Total	[r]20,598	21,358	21,658	22,451
All others	[r]510	524	509	542
Grand total	[r]21,108	21,882	22,167	22,993

[e] Estimate. [p] Preliminary. [r] Revised.

[1] Reported figure.

[2] Includes the country's share of production from the Kuwait-Saudi Arabia Partitioned Zone.

Table 37.—Leading world producers of refined oil

(Million 42-gallon barrels)

Country	1976	1977	1978^p	1979^e
United States (including Puerto Rico and Virgin Islands)	5,479	5,923	5,957	[1]5,889
U.S.S.R	3,087	3,325	3,412	[2]3,513
Japan	1,661	1,701	1,688	1,696
France	902	892	920	978
Germany, Federal Republic of	821	772	778	953
Italy	^r833	856	866	885
United Kingdom	723	638	729	726
Canada	625	659	664	711
China, mainland^e	^r548	650	600	620
Netherlands	^r490	448	427	468
Brazil	348	358	385	402
Venezuela	^r361	356	382	367
Mexico	^r277	309	327	368
Spain (including Canary Islands)	376	355	351	356
Saudi Arabia[3]	^r257	277	295	295
Singapore	173	217	249	252
Belgium	213	269	250	250
Australia	215	226	226	236
Iran	256	274	249	234
Netherlands Antilles	226	198	215	222
India	168	181	196	215
Korea, Republic of	132	158	174	189
Argentina	166	177	177	182
Romania	^r157	157	175	178
Indonesia	83	113	121	160
Kuwait[3]	^r134	126	133	156
Total	^r18,690	19,615	19,925	20,424
All others	^r2,668	2,814	2,910	3,037
Grand total	^r21,358	22,429	22,835	23,461

^e Estimate. ^p Preliminary. ^r Revised.

[1] Data comprises reported figures for the United States and Puerto Rico and an estimate for the Virgin Islands.

[2] Reported figure.

[3] Includes the country's share of production from the Kuwait-Saudi Arabia Partitioned Zone.

Ocean Minerals

By William T. Cocke[1]

The mining of deep seabed nodules, although yet to become a commercial reality, was the subject of much discussion on both national and international levels during 1978 and 1979. These nodules, which could become a significant future source of nickel, copper, cobalt, and manganese, are found in large quantities in deep ocean areas beyond the jurisdiction of any nation. The Third United Nations Conference on Law of the Sea (UNCLOS III) has sought to establish an international regime to control the exploitation of the nodules. The Seventh and Eight Sessions of UNCLOS III convened in 1978 and 1979, respectively, but no final consensus was reached, and no agreement was forthcoming.

Domestic seabed mining legislation was introduced into both the 95th and 96th Congresses. A bill was passed by the House of Representatives in 1978 and another by the Senate in 1979, but neither was further acted upon.

There was much activity also by international ocean-mining consortia. Several prototype mining tests were conducted, demonstrating the concept of nodule recovery. Development of nodule-processing techniques continued, and plans for construction of pilot processing plants were announced. There also was curtailment of seabed mining activities by some major partners within the various consortia.

There was considerable activity in offshore exploration, especially for sand and gravel. The rapid increase in the price of gold stimulated exploration activity for offshore gold deposits throughout the world.

LAW OF THE SEA

The Seventh Session of UNCLOS III was convened in Geneva from March 28 to May 19, 1978. At the outset, 2 weeks of debate ensued concerning the reelection of Mr. Amerasinghe, who has served as president since 1973.

Seven negotiating groups (NG's) on outstanding key issues were established. Only the first three were related to Part XI of the Informal Composite Negotiating Text (INCT) dealing with deep seabed mining. NG-1 was to consider the system of exploration and exploitation and resource policy, NG-2 was to consider financial arrangements, and NG-3 was to consider the composition of the organs of the International Seabed Authority (Authority) and their powers and functions. The various NG's issued revised texts, which showed improvement over the ICNT and offered improved prospects of achieving consensus.

The major features of the NG-1 text were as follows: (1) Transfer of technology was no longer a condition of obtaining a deep seabed mining contract. (2) There is no longer automatic conversion from the parallel system of exploitation to a unitary system if the Review Conference, which meets 20 years after the approval of the first contract, fails to reach agreement of a revised mining system within 5 years; however, a moratorium of new contracts could still be invoked. (3) A provisional U.S.—Canadian agreement on production limitation was incorporated. (4) The coordination of marine scientific research by the Authority was eliminated.

The major feature of the new texts issued by NG-2 was the articles on financial arrangements that were redrafted in a way far clearer than the ICNT. Several systems were under consideration although no agreement was reached. The MIT Cost Model was used as a basis for discussion.

Revised texts forwarded by NG-3 contained only minor changes. The issue of composition and voting in the Council, the major organ of the Authority, was discussed at length but was not resolved.

The Seventh Session resumed in New York on August 21, 1978, and concluded on September 15, 1978. Although steady progress toward completion was made on less controversial matters during the Conference, the key issues dealing with deep seabed mining remained intractable. At the outset of the session, the Chairman of the Group of 77 (G-77), speaking on behalf of 119 delegations of developing countries, urged industrialized nations to refrain from enacting unilateral legislation on deep seabed mining, claiming that such mining activities would violate international law and would seriously prejudice the prospect for agreement in negotiations.

Negotiations in NG-1 centered on selection of applicants for seabed mining contracts. Discussions on technology transfer were deferred and minimal progress was achieved.

Negotiations in NG-2 concerning financial arrangements exposed widely varying assumptions on the part of developed and developing countries, and emphasized the difficulty of arriving at a common agreement on economic limits of financial obligation. Application fees, annual fees, production charges, and profit-sharing were all considered. Both royalty-only and royalty-plus-profit-sharing plans were proposed. Problems arose concerning the choice of an internal rate of return of 15%, which was used as the baseline case in the MIT Cost Model; and with attributable net proceeds (ANP), or that part of capital costs attributable to mining but excluding transportation and processing costs.

There was little substantial difference between the revised texts from NG-3 and the ICNT. Composition of the organs of the Authority remained the most contentious issue.

Some 90% of the issues confronting the Conference were resolved to the satisfaction of the United States and most participants, such as the right of transit through international straits, overflights, conservation of living resources, protection of the marine environment, and fishing rights. However, the following outstanding key issues associated with deep seabed mining remained unresolved: (1) Assured non-discriminatory access to minesites, (2) production contracts, (3) the Review Conference, (4) power of the Authority, (5) transfer of technology, and (6) financial arrangements and profit-sharing.

The Eighth Session of UNCLOS III met in Geneva from March 19 to April 27, 1979. The G-77 presented a statement on the first day challenging the legality of unilateral deep seabed mining. For the first 2 weeks, the Conference concentrated on deep seabed issues of Committee I. A Working Group of 21 (WG-21) was established to consider issues not yet resolved in NG-1, NG-2, and NG-3. The Chairman of Committee I also established a Group of Legal Experts to work on the important problems of settlement of disputes with respect to the seabed. Similarly, a Group of Technical Experts was working on the question of production limitations.

The revised texts from NG-1 included changes concerning transfer of technology, whereby the obligation to the contractor was not contingent upon the nonavailability of the technology on the open market, and transfer within fair and reasonable commercial terms would be settled by commercial arbitration. The so-called Brazil Clause, which requires transfer to developing nations, remains. The problem of the Review Conference was not improved upon, and the imposition of a mining moratorium is still permitted.

The revised texts from NG-2 concerning financial obligations were not acceptable to the United States. They outline contractor payments to the Authority through either a royalty-plus-profit-sharing or a royalty-only system and contain application fees and annual fees creditable against royalty payments after production begins. Royalties and profit-sharing were broken into stages which reflect production development. Problems still persist in the figure for ANP. Several incremental systems based on the contractor's profitability were considered. Consensus on financial arrangements was hampered by the fundamental issue of in situ value of the nodules, and the answer might have to await actual operations, at which time mining profit can be determined.

While little progress was made within NG-3 concerning composition of and voting in the Council, the Group of Legal Experts on seabed disputes was able to produce a new text, incorporated into the NG-3 revised text, which clarified questions concerning access to and jurisdiction of the Seabeds Disputes Chamber.

An agreement was reached by the Conference to issue a revision of the INCT, now referred to as INCT/Rev. 1, containing the new texts from the negotiation groups. ICNT/Rev. 1. although not representing consensus, offered an improved basis for further negotiation.

The Eighth Session was resumed in New York from July 16 to August 24, 1979. The work of the Conference was devoted to the major outstanding issues not resolved by INCT/Rev. 1. There were no meetings of NG-1, NG-2, or NG-3; however, the Chairman of the NG's conducted negotiations within the framework of WG-21. The Group of Legal Experts continued its work on settlement of seabed disputes. New texts on financial arrangements moved significantly toward a consensus. Voting in the Council still remains unresolved and there was little discussion concerning composition of the Council. No new texts were issued on transfer of technology. Profit-sharing and the Review Conference remained outstanding issues. Another problem that remains unresolved concerns the fact that the ICNT/Rev. 1 does not limit the sharing of financial benefits of the seabed resources to State Parties to the Conference. Specifically, it might allow national liberation organizations to share the profits and to become party of the treaty. Agreement was reached on an initial tonnage for a minimum floor on seabed production. New proposals on financial arrangements were a major step toward flexibility by applying an incremental schedule of rates.

At the close of the session, the Chairman of G-77 gave a statement reiterating opposition to unilateral deep seabed mining legislation, challenging its legality, and arguing that it would violate good faith in negotiations.

The most important problems remaining in the deep seabed mining provisions are as follows: (1) agreement on finial numbers in the production ceiling; (2) provision for a moratorium on contracts by the Review Conference; (3) composition and voting in the Council; (4) access to commercial arbitration for contractural dispute settlement; (5) the Brazil Clause, time limits, and dispute settlement relating to technology transfer; (6) selection of applicants; (7) financing the Enterprise; and (8) lack of agreement on financial arrangement for profit-sharing.

The Conference decided to hold its final substantive session in two 5-week stages in 1980, the first in New York beginning February 27, and the second in Geneva beginning July 28. A timetable was proposed which called for the final draft and proposed amendments to be completed at the end of the first 1980 session and all final amendments and technical problems to be worked out at the resumed session.

In addition to the sessions, there were formal UNCLOS III intersessional meetings, various group meetings, and informal consultations throughout the 1978-79 period. The United States took part in numerous bilateral and multilateral meetings during this period.

DOMESTIC LEGISLATION

Domestic deep seabed legislation was first introduced in 1971, but progress was hindered by the fear that its unilateral nature would threaten negotiations at the Law of the Sea Conferences. At the close of the Sixth Session of UNCLOS III, however, the

U.S. Government announced support of domestic legislation with the exception of several provisions, primarily those calling for U.S. guarantees covering 90% of industry investment losses to a maximum of $350 million, resulting from an unfavorable UNCLOS III treaty. In lieu of Government guarantees, the Administration favored a "Grandfather rights" provision in the prospective treaty.

H.R. 3350.—On February 14, 1978, the Committee on International Relations of the House of Representatives ordered H.R. 3350 reported with recommendation for amendments. The Committee rejected provisions calling for investment guarantees. It also recommended inclusion of an International Revenue-Sharing Trust Fund.

Hearings were held by the Committee on Ways and Means in April 1978 to consider the revenue-sharing provision. The proposal called for a 3.75% tax on the imputed value of the recovered resources, to be computed on 20% of the market value of the metal derived from nodule processing. The Administration testified in favor of the provision. Testimony on behalf of the American Mining Congress also urged the Committee to accept the proposal, in spite of the fact that industry had consistently opposed revenue-sharing in the past.

The Committee on Interior and Insular Affairs also rejected investment guarantees. Substitute language directed U.S. negotiators at UNCLOS III to insure that any treaty signed by the United States would allow mining operations to continue under "substantially the same" conditions that existed before the treaty. The Committee indicated any treaty that would unduly hamper ongoing U.S. operations would not be accepted.

Elimination of investment guarantees and acceptance of the Revenue-Sharing Fund cleared the way for passage of the bill by a vote of 312-80 of the full house on July 26, 1978. Regulatory jurisdiction was granted to the Department of Commerce over the Department of the Interior by a small vote margin.

S. 2053.—A similar bill, S. 2053, was reported from the Senate Committee on Energy and Natural Resources in May 1978, with an amendment proposal calling for a voluntary insurance plan to protect the industry from investment losses due to an unfavorable UNCLOS III treaty. Regulatory responsibility was placed with the Department of the Interior.

The Committee on Foreign Relations reported the bill in August 1978 with an amendment favoring a revenue-sharing plan. Regulatory authority was granted to the Department of the Interior.

Although substantial agreement was reached by four Committees, S. 2053 never reached the Senate floor for vote. Neither S. 2053 nor H.R. 3350 were acted upon by the Senate before adjournment of the 95th Congress.

During the course of Congressional hearings in the 95th Congress, the Administration's testimony in support of deep seabed mining legislation could be summarized as follows:

1. The legislation must be interim in nature, pending agreement on an UNCLOS III treaty.
2. It must be based on the premise that deep seabed mining is a freedom of the high seas.
3. It must provide for environmental protection, sound management, safety of life and property at sea, and effective law enforcement.
4. It must establish an international revenue-sharing fund.
5. It must encourage recognition of rights of reciprocating states.
6. It must contain requirements that mining and processing vessels, but not transportation vessels, fly the flag of the United States of a reciprocating state.
7. It must not require U.S.-based processing.
8. It must not contain investment guarantees.
9. It must not be misinterpreted as an assertion of sovereignty over specific mine sites.

S.493.—On February 26, 1979, Senator Matsunaga introduced S. 493, the Deep Seabed Hard Minerals Resources Act, into the Senate of the 96th Congress. It was referred jointly to the Committees on Energy and Natural Resources, Commerce, Science and Transportation, and Foreign Relations for consideration.

Hearings were held beginning in March to hear testimony from representatives of the Administration and ocean mining industry, environmentalists, and the general public. Administration witnesses requested amendments to provisions requiring U.S. documentation of vessels and recommended a requirement calling for United States or reciprocating state documentation. The Administration also opposed requirement for location of processing plants in the United States. The Administration testified that the language of the "Grandfather rights" provisions was too strong and inferred moral if not legal obligation to the U.S. Government to compensate companies for losses due to UNCLOS III treaty provisions that were less advantageous. The Administration requested that the data for issuances of licenses be changed to July 1, 1981, and the date for earliest commercial recovery be changed to July 1, 1982. The U.S. Government also requested that provisions of the Clean Water Act be applied to regulation of polluting discharges from seabed mining and related at-sea processing.

The bill was reported with amendments from the Committee on Energy and Natural Resources on May 1, 1979, from the Committee on Commerce, Science and Transportation on July 27, 1979, and from the Committee on Foreign Relations on July 30, 1979. A joint report of the three committees was published August 9, 1979. Amendments listed in the report accomplished the following:

1. Changed the authority for regulatory functions from the Secretary of the Interior to the Administrator of the National Oceanic and Atmospheric Administration (NOAA).
2. Set the date for licenses at July 1, 1981, and earliest date for commercial recovery at January 1, 1982.
3. Called for mining and processing vessels to be constructed and documented in the United States.
4. Laid out requirements for a work plan.
5. Softened the language of the "Grandfather rights" provisions.
6. Struck the provision for stable reference areas.

The bill was referred jointly to the Committees on Finance and Environment and Public Works to consider provisions which dealt with international revenue-sharing. The excise tax proposal called for a 3.75% tax imposed on the imputed value of the nodules removed from the deep seabed. The imputed value for this purpose was 20% of the fair market value of the commercially recoverable metal and minerals contained in the nodules which represents the estimated proportional share of the costs of the mining process itself in relation to the total costs involved in mining, transporting, processing, and marketing the nodules. The proceeds of the tax were to be paid into a Deep Seabed Fund established under Title V of the legislation. The committees reported the bill without amendment on October 3, 1979.

On December 14, 1979, the Senate passed S. 493 after agreeing to the above amendments.

H.R. 2759.— On March 8, 1979, Representative Murphy introduced H.R. 2759, the Deep Seabed Hard Minerals Resources Act, into the House of Representatives of the 96th Congress. It was referred jointly to the Committees on Foreign Affairs, Interior and Insular Affairs, Merchant Marine and Fisheries, and Ways and Means.

Hearings were held by the Committees on Merchant Marine and Fisheries and Interior and Insular Affairs beginning in May. Testimony was given by representatives of the Administration, industry, environmentalists, and the public. The witnesses and testimony were basically the same as for S. 493.

Although the industry basically supported domestic legislation as an alternative to the establishment of an international regime, there were some provisions with which it differed. It opposed setting dates for liscenses and permits for the mid-1980's because provisions would make it impossible to commit large sums of additional funds, although the data for first commercial recovery has been set at about 1985. Industry requested that the "Grandfather rights" provisions be strengthened. Industry was opposed to stable reference areas being set aside. It accepted the profit-sharing provisions and those provisions called for U.S. flag requirements and U.S.-based processing.

The Committee on Interior and Insular Affairs reported the bill on August 2, 1979, with the following amendments: (1) Interior was made lead agency, (2) a workplan was required, (3) U.S. documentation of mining and processing vessels and at least one transport vessel was required, (4) "Grandfather rights" provisions were amended, but not to the extent requested by the Administration, and (5) the dates for issuance of licenses and for earliest commercial recovery were amended as requested by the Administration.

The Committee on Merchant Marine and Fisheries reported the bill on August 17, 1979, with the following amendments: (1) Requirement for applicant certification and work plan were required, (2) a disclaimer of obligation for U.S. Government to compensate industry losses was added to the

"Grandfather rights" provision, (3) the dates for issuance of licenses and permits were adjusted according to Administration recommendations, and (4) U.S. flag requirements for mining and processing vessels and at least one transport vessel were specified.

The Committee on Ways and Means held hearings to consider the subject legislation and on November 2, 1979, reported H.R. 2759 without amendment.

The Committee on Foreign Relations held serveral hearings in 1979 to hear testimony from various witnesses representing the Administration, industry, and the public; however, H.R. 2759 was not reported out of Committee by the close of the 1979 session of the 96th Congress.

OCEAN MINING CONSORTIA ACTIVITIES

Ocean Management Inc. (OMI).—Tests of submerged contrifugal dredge pump and airlift pump systems were conducted by engineers of Inco Ltd. for OMI on three cruises aboard the *Sedco 445* between February 5 and May 20, 1978. On March 28, 1978, OMI became the first of the major consortia to pump nodules from the deep sea floor (5,000 meters) to a surface vessel. About 850 tons of nodules was recovered from an area 800 miles southeast of Hawaii at rates as high as 40 tons per hour. The mining tests were monitored by NOAA's Deep Ocean Mining Environmental Study (DOMES) at the test site located near DOMES Site A from the NOAA vessel, *Oceanographer.*

Due to the uncertain outlook for nickel and copper markets and the legal uncertainty surrounding the fiscal regime under which Deep Seabed Mining (DSM) would operate, no further work was planned by Inco beyond the completion and analysis of this pilot mining test. Inco closed its Bellevue, Wash., office by November 1978, at least three new companies had been formed by former Inco technical personnel. OMI intended to halt work for 3-5 years or until the financial and political climate improves. It was expected, however, that other members of the consortia will continue their DSM programs.

Exploration will continue under the sponsorship of the AMR Group. Walter Kollwentz was appointed as the new president of OMI, and management of the group was moved to the Metallgesellschaft Headquarters in Frankfurt, Federal Republic of Germany. AMR was continuing nodule exploration with a new research vessel, the *Sonne,* which replaced *Valdavia* in July 1978. The *Sonne* was expected to be operating during the next 8 years. AMR was also conducting nodule processing studies. Leaching and smelting and nitric acid reduction methods were being investigated.

Japanese members of OMI were continuing efforts on an increased funding basis. The Japanese Government sponsored the construction of a new deep sea minerals exploration vessel. The $18.6 million *Hakerei Maru II* was launched in November 1979. The Sumitomo Group was also conducting metallurgical investigations.

Ocean Mining Associates (OMA).—On the third cruise of the *Deepsea Miner II* between May 23 and June 29, 1978, engineers from Deepsea Ventures Inc.(DSV) conducted pilot mining tests of an airlift nodule mining system on belf of OMA. Nodule production was first achieved on June 8, 1978, at the DSV "claim" area (approximately 15%N. 126%W), 1,200 miles southwest of San Diego in 4,500 meters of water. The 6,000 to 8,000 tons of nodules that were planned to be recovered from sustained production at design capacity of 1,000 tons per day were not collected due to an early start of the hurricane season. Mining test were monitored by the DOMES project.

On the fourth cruise of *Deepsea Miner II,* which began on October 25, 1978, testing continued for 36 days, during which the system exhibited 90% efficency in nodule recovery. The tonnage of nodules collected, although less than planned, was sufficient for completion of process development tests by consortium partners. United States Steel was conducting pyrometallurgical experiments, while Union Miniere was conducting hydrometallurgical tests in Europe.

It was expected that about 18 months would be required to evaluate the tests. Due to poor metal market conditions and the uncertain status of UNCLOS III negotiations, *Deepsea Miner II* will remain idle for this period. OMA, however, retains strong commitments for exploration and test mining.

Kennecott Group.—During 1978, Kennecott investigated several schemes for a hydraulic nodule collector system; however, no data were released. In late 1978, Kennecott announced that it was terminating its nodule development program, apparently the result of oversupply and low prices in both the nickel and copper markets. The Kennecott Ocean Mining Lab in San Diego has been shut down. No announcement has been made as to further DSM plans of Kennecott or its partners in this effort.

Ocean Minerals Co. (OMCO).—The first cruise of the *Glomar Explorer* in November 1978 into the northeast Equatorial Pacific high-grade nodule zone for the initial testing of the Lockheed-designed airlift hydraulic nodule mining system was terminated prematurely owing to a vessel malfunction, and only the shallow-water testing was completed. The second cruise, in February 1979, was also terminated prematurely this time due to design problems in the nodule collector. There were no immediate plans to return to sea.

OMCO leased the research vessel, *Governor Ray,* for a period of 11 months for nodule deposit explorations. Detailed surveys were conducted in areas planned for mining system tests.

Although OMCO announced plans to build a test plant in Hawaii for processing of seabed nodules, plans were allowed to slip due to unsuccessful mining system tests which were to have provided a supply of nodules. The $4 million plant was expected to begin operations in mid-1979 and was expected to be in operation for 3-5 years. It was to handle about 50 tons of nodules per day at an estimated cost of $1 million per year. Work had not been completed by the end of 1979, and future plans were not disclosed, although the uncertain future of the DSM industry is apparently affecting further expenditures.

Continuous Line Bucket (CLB) Group.—Although airlift and centrifugal pump hydraulic methods were still preferred, there was further work done on the mechanical CLB method. Estimates have shown the CLB method to be more energy-intensive than the hydraulic methods but less capital-intensive. The two-ship CLB test planned for 1979 by Dr. John Mero's Ocean Resources was postponed; plans now call for a test in 1980. The French and Japanese were still investigating this nodule recovery method.

AFERNOD.—The French consortium, AFERNOD, concentrated its study in the high-grade-deposit area of the Pacific Ocean in the Clarion-Clipperton Fracture Zones. It was, however, also investigating areas of other oceans, and the French oceanographic vessel *Marion Dufresne* located nodules in the Indian Ocean in 1979, described as less rich but more plentiful than those in the Pacific Ocean. Nodule densities as high as 100 kilograms per square meter were reported.

Although AFERNOD had investigated hydraulic mining systems and several promising second-generation mining techniques, efforts were directed primarily toward the CLB system. Major difficulties had been identified in the hydraulic system, and exotic shuttle vehicle prototypes constructed by Commissariat a l'Energie Atomique (CEA) and Chantiers de France Dunkerque were felt to be of little commercial interest for the immediate future.

CEA, the French atomic energy commission, constructed two pilot plants in 1978 for testing nodule-processing systems, one each to test the ammonia leach and sulfuric acid leaching methods.

Deep Ocean Mining Associates (DOMA).—DOMA, a consortium of private Japanese companies, had a limited staff and derived its capability from technical committees formed by the Japanese Government and the companies. DOMA received funding and contracts for technical studies from the Japan Ministry of International Trade and Industry (MITI), in addition, the National Research Institute for Pollution and Resources of MITI was continuing sealed-down tests of both one-and-two-ship CLB operations. Little was published of the activities of DOMA with exception of references in reports of the Japanese Geological Survey.

Other Ocean Mining Activities.—As part of its major program of academic research in marine geology, the U.S.S.R. did considerable work concerning deepsea nodule deposits in the Pacific Ocean, but no specific attention was given to the deposits in relation to commercial development. The Geological Survey of India conducted offshore surveys to locate deposits of manganese nodules in the Indian Ocean and announced plans for the design and construction of an offshore research vessel. Mainland China was also reportedly investigating manganese nodule resources in the Pacific Ocean.

The 60-square-kilometer Atlantis II Deep basin area of the Red Sea metalliferous mud deposits was the site of successful pilot mining test in 1979. Orestein and Koppel AG, working under contract to Preussag AG, developed the mining system, which consists of a specially designed vibrating suction sieve coupled to a series of hydraulic pumps. The work was funded by the Saudi-Sudanese Commission for the Development of Red Sea Resources. Shallow tests were conducted in Luebeck Bay in the North Sea and the River Trave, and deep tests, in the Mediterranean Sea prior to the system's deployment at the Atlantis II Deep aboard the *Sedco 445*. About 3,500 cubic meters of material was lifted and stored.

A pilot plant was to be built at Yanbu, Saudi Arabia, to analyze the samples. Preussag also was reportedly working on the development of a processing technique. A patent was assigned to Fried. Krupp GmbH for the extraction of copper and zinc from the Red Sea muds.

Offshore Activities.—Sand mining in Japan was the most extensive offshore activity. About one-fifth of all sand and gravel mined in Japan was by offshore dredging, typically at least 2 kilometers from shore, in water at least 20 meters deep. Deep suction sand dredges were developed in 1978 which operated to maximum depths up to 80 meters.

The other major offshore sand mining area was northern Europe where 10 nations were either engaged in mining in 1978-79 or planning to mine. The main producers were the United Kingdom, Sweden, and France. The United Kingdom recovered well over 10% of its 1978-79 aggregates by marine mining. Typically, a dredge worked at least 5 kilometers from shore in 18-24 meters of water.

In the United States, the main public concern for offshore dredging of sand and gravel was the potential harm to the marine environment. In addition, there was concern about shoreside stockpiling and processing facilities and the possible use of offshore sand and gravel to fill in wetlands.

In areas such as Los Angeles and the Virgin Islands, accelerating costs of onshore aggregate material suggested that use of offshore material would be required. The Virgin Islands Sand Mining Project was set up by the Territorial Government to investigate the potential for offshore sand and gravel. Deposits were investigated off California because of political and environmental limitations on mining of land deposits of saleable aggregates; however, possible mining of these deposits aroused some environmental concerns.

Sand and gravel deposits were discovered off Poland of sufficient size to be exploited at a rate of about 3 million tons per year for several years, although the extent of the deposits was not fully assessed. Deposits of heavy minerals such as zircon and magnetite and of silica sands suitable for use in glassmaking were also indicated.

Exploration for alluvial tin was generally confined to a 2,900 kilometer long granite belt that runs from northern Burma southward through peninsular Burma and Thailand to west Malaysia and the Indonesian Islands. The Thailand Offshore Mining Organization awarded mining licenses for dredging of cassiterite from deposits in the Andaman Sea. The Thailand Government reduced royalities for tin production so that overall charges were reduced from 33.17% to 28.4% of gross proceeds. As many as 500 small-scale illegal dredging operations had begun to deplete the thin deposits.

Tin was mined offshore of Indonesia by dredging to depths of 40-50 meters. Up to 60% of Indonesian tin was from offshore.

Offshore prospecting for tin was carried out in the Lumut area of Malaysia previous to commencing dredging operations.

Uranium was discovered in the sediments of the Black Sea offshore of Turkey. As much as 7 million tons of U_3O_8 may be contained in the deposits covering 259,000 square kilometers at depths from 1,070 to 2,135 meters. Deposits were fine-grained and nonconsolidated, and mining by suction dredge appeared possible.

Offshore sampling was conducted of the terrigenous sediments at the mouth of the Matepono River off the north coast of Guadalcanal. The only gold-bearing samples were located at the present and former mouths of the river. Gold content ranged from 0.045 to 0.087 part per million.

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[1] General Engineer, Branch of Technology Transfer.

The Mineral Industry of Afghanistan

By E. Shekarchi[1]

The status of Afghanistan's mineral industry remained unchanged from 1977 to 1978 and declined considerably during 1979. In April 1978, the People's Democratic Party of Afghanistan overthrew the Daoud government and mounted a revolutionary program aimed at strengthening the public sector of the economy with scientific planning. The 5-Year Plan (1979-84) for the economic development of the country was formulated, and considerable emphasis was laid upon the production of coal and minerals. To implement this plan, the authorities at the time allocated[2] $58 million to the budget. Apparently, mineral production for 1978 was carried forward by the momentum of the previous year. However, during 1979, because two more civil disturbances in the country resulted in two new governments and owing to the entrance of the Soviet Union's army into the country, the mineral industry not only failed to perform up to expectations of the 5-year plan, but also lagged considerably behind performances of 1978. The only mineral production not affected by all these events was natural gas output of which more than 90% was exported to U.S.S.R. By the end of 1979, the U.S.S.R. and other East European countries were prepared to be generous in aid during the 5-year plan, but with the U.S.S.R. army present in the country and the unstable political situation, it was very doubtful that normal economic life in 1980 would be possible. Therefore, the Ainak copper deposits, Hajigak iron deposits, and the development plans for any marble, coal, chromite and uranium remained untouched. Some lapis lazuli found its way into the international market in 1978, but in 1979 no exports were reported. The remittances of Afghan workers ($100 million in 1977), practically dried up during 1978-1979 because Iran had a government change and economic difficulties of its own. To remedy the economic ills, Afghanistan requested that various countries forgive or reschedule its debts, after apparently losing its request on a United Nations resolution "urging debt relief for least developed countries." Nearly two-thirds of Afghanistan's debts were owed to the U.S.S.R. By the end of 1979, the countries that reportedly agreed to forgive Afghanistan's debts included Great Britain, Canada, Sweden, West Germany, and Japan.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted for Afghanis (Afs) to U.S. dollars at the rate of Afs45=US$1.00.

Table 1.—Afghanistan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
Asbestos	13,260	13,000	[e]13,000	4,000
Barite	5,316	12,100	12,930	3,000
Cement, hydraulic	[e]167,000	136,000	127,000	140,000
Coal, bituminous	164,131	182,000	212,725	100,000
Gas, natural:				
Gross[e] million cubic feet	96,000	90,000	90,000	70,000
Marketed do	89,805	[e]84,000	81,824	60,000
Gem stones: Lapis lazuli kilograms	7,406	6,310	1,984	6,000
Gypsum	NA	NA	6,648	--
Natural gas liquids thousand 42-gallon barrels	9	[e]10	[e]10	10
Nitrogen, N content of ammonia[e]	35,000	35,000	25,000	25,000
Salt, rock	69,583	77,684	81,112	20,000
Talc	8,685	5,711	1,775	500

[e]Estimate. [p]Preliminary. NA Not available.

[1] In addition to the commodities listed, a variety of crude construction materials (clays, stone, and sand and gravel) presumably is produced, but output statistics are not available and general information is inadequate to make reliable estimates of output levels.

Table 2.—Afghanistan: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	Principal destinations, 1976
Fertilizer materials, manufactured, including mixed	13,944	All to Pakistan.
Iron and steel: Steel, primary forms	5,070	Do.
Precious and semiprecious stones, except diamond value	$17,250	Hong Kong $15,200; Saudi Arabia $1,820; United States $208.
Stone, dimension, worked	1	All to Iran.

[1] Data are for the year beginning Mar. 21 of that stated.

Table 3.—Afghanistan: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	Principal sources, 1976
METALS		
Copper metal including alloys, all forms	428	Pakistan 335; West Germany 79; Iran 13.
Iron and steel metal:		
Pig iron, ferroalloys, similar materials	18	All from Pakistan.
Steel, primary forms	46	Pakistan 24; Iran 21.
Semimanufactures:		
Bars and rods	186	Japan 169; West Germany 11; Hong Kong 5.
Angles, shapes, sections	346	Japan 290; Iran 28; Pakistan 28.
Universals, plates, sheets	10,023	Japan 8,133; U.S.S.R. 1,081; Iran 421.
Wire	658	Belgium-Luxembourg 347; Japan 257; Hungary 40.
Tubes, pipes, fittings	1,358	West Germany 461; Japan 413; India 338.
Castings and forgings, rough	7,118	U.S.S.R. 3,468; Japan 1,846; Czechoslovakia 892.
Lead metal including alloys, all forms	2	Czechoslovakia 1; West Germany 1.
Zinc metal including alloys, all forms	(2)	All from Pakistan.
NONMETALS		
Abrasives: Grinding and polishing wheels and stones value	$87,250	India $77,816; United Kingdom $4,711; Pakistan $3,489.
Cement	60,071	U.S.S.R. 60,000; Pakistan 71.
Clay products	330	West Germany 241; Italy 43; Czechoslovakia 30.
Salt, excluding brines	3,237	Pakistan 3,135; West Germany 99.
Sodium compounds, n.e.s.: Caustic soda	1,301	U.S.S.R. 717; United Kingdom 262; Pakistan 241.
Stone, dimension, worked	2	All from Iran.
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke, peat	665	All from U.S.S.R.
Gas, hydrocarbon, manufactured value	$24,468	Pakistan $23,109; Japan $844; United States $278.
Petroleum refinery products:		
Gasoline 42-gallon barrels	9,678	All from Iran.
Kerosine do	163,491	Iran 134,861; U.S.S.R. 28,630.
Jet fuel do	108,859	Iran 98,454; Kuwait 10,405.
Lubricants do	42,969	United Kingdom 18,244; Austria 10,381;United States 5,761.
Mineral jelly and wax do	1,491	Netherlands 877; West Germany 192; Iran 159.
Petroleum asphalt do	91,627	All from Pakistan.

[1] Data are for the year beginning Mar. 21 of that stated.

[2] Less than 1/2 unit.

The Mineral Industry of Albania

By Walter G. Steblez[1]

In 1978-79 Albania witnessed a watershed period in the development of its economy and mineral industry. During the summer of 1978, Mainland China, which accounted for 35% to 40% of Albania's foreign trade, withdrew its long-standing economic and technical assistance, thereby causing major dislocations in many construction projects, including those related to mining and metallurgy.

Despite these difficulties, however, Albania was able to foresee the possibility of such a rift, and was able to secure sufficient supplies of raw materials, spare parts, and other products not met by domestic production on the basis of 1978 exports and past state measures taken to accumulate material and currency reserves. Another result of the breakoff of economic ties with China was a restatement of a policy of total political nonalignment as well as complete economic self-sufficiency.

With approximately 42% of its estimated 165,000-person industrial labor force involved in the mineral industry, Albania maintained its position as the world's third largest producer of chromite in 1978-79, and, despite the paucity of published statistical data, Albanian sources clearly stress the relative importance of its mining-mineral industry to its planned economy.

Currently, 23 kinds of minerals are being commercially produced, including chromium, copper, ferronickel, pyrite, bitumen and marble, phosphorites, magnesium, quartz, dolomites, kaolin, petroleum, gas, and coal. In the near future, recently discovered reserves of nickel-silicate ores, polymetallic ores, bauxite, asbestos, titanic magnetite ore, among others, will be commercially exploited.

Petro Dode, Chairman of the State Planning Commission, reported that although overall industrial production rose 6% in 1978 over that of 1977, the output of chrome and copper ores, coal, chemical fertilizers, ferrous metallurgy products, electric power, machinery, and other durables increased from 7% to 20%. This trend was maintained in 1979 with an 8% increase of industrial output over the 1978 level at a 97.5% plan fulfillment. Reportedly, national income rose 14% during that year. Other centrally planned economic indicators for this period are as follows: Revenues to the State Budget, the main source for financing the national economy, increased 6.4% and 11.6% in 1978 and 1979, respectively, over those of the preceding years; and capital investment for the development of industry, mining, geology, agriculture, transportation, etc., was set at 4.766 billion leks in 1979, following a 90.7% planned expenditure fulfillment in 1978. In 1978, planned investment was set at 18% over that of the preceding year; in 1979, at 12% over that of 1978.

In 1978, a new Guri-i-Kuq ferronickel mine and beneficiation plant, additional facilities at the Steel of the Party metallurgical complex at Elbasan, and the Valias coal mine were put onstream. Other completed projects included the addition of two turbines at the Light of the Party hydroelectric plant, the completion of the Fierzë hydroelectric plant, and an estimated 20,000-barrel-per-day petroleum refinery in Ballësh. Also, in 1978, official sources report the discovery of new petroleum and gas deposits.

Plans for the continued expansion of existing industrial enterprises as well as for the construction of new ones were officially adopted in 1978, among which were (1) facility expansion of the chrome beneficiation plant in Belqizë, (2) a new copper beneficiation plant in Pukë, (3) expansion and modernization of the existing cement industry including the production of white cement, and (4) control automation of the Drin Cascade hydroelectric plant.

Reportedly, in 1979 the growth rate of industrial output exceeded each of the preceding years in the sixth 5-year plan. During the same year, a number of important projects were completed and put into operation: A ferrochrome plant in Burrel, a chrome-ore beneficiation plant in Kalimash, and a copper-smelting plant in Laç. The expansion of capacity was achieved at the Steel of the Party metallurgical complex with the addition of the first iron concentrate production line and at the Light of the Party hydroelectric powerplant with the addition of a third turbine. Also of note was the discovery of new chrome, copper, ferronickel, coal, petroleum, and gas deposits in 1979, the reported completion of Albania's first petroleum deep-drilling rig prepared by a Stalin city machine building plant, and the first 1,500-meter hydraulic probe for geological drillings.

Apart from the achievements and growth in the Albanian mineral industry, many industrial shortcomings and enterprise plan fulfillment failures were reported. In 1978 and 1979, difficulties were cited in a number of enterprises of the coal, petroleum, cement, and other industries, where set tasks of the production plan were not met.[2] Among the reasons given by official sources were mismanagement, poor labor and heavy-equipment utilization, failure due to inadequate use of transport equipment, low mechanization, and a high degree of labor-intensive operations at many enterprises.[3] For example, although 1978-79 marked the beginning and expansion of machinery and equipment production needed for mechanizing mining operations, at enterprises like Tirana's Dinamo plant there appears to be a shortage of spare parts causing stoppages and delays in output.[4]

The level of mechanization at many mining enterprises can be described as uneven, at best. It is reported that the Manzë coal mine in Durrës has increased labor productivity with emphasis given to the mechanized transport of coal both inside and outside the mine; however, at other enterprises such as the Alarup coal mine, only 38% of the loading process is mechanized.[5] Underutilization of transport equipment and losses of coal during transportation in the Tirana District, where approximately 33% of Albanian coal is extracted, is also reported, and the Ministry of Industry and Mining has been urged to utilize all available cable cars to transport minerals, timber, and other materials.

Other difficulties are admitted at the Steel of the Party metallurgical complex at Elbasan and in the petroleum industry. In the former case, apart from poor work and low productivity, serious shortages of domestic coal and dolomite from the Korçë and Selenicë mines were reported to be due to transportation mismanagement. For the first 9-month period of 1979, this represented a deficit of 20,838 tons of coal from the Korcë Mine and 6,460 tons of dolomite from the Selenicë Mine.[6] In the latter case, poor labor organization is cited as a problem at the new Ballësh petroleum refinery.

The petroleum industry, in general, has been singled out as not having met its planned rate of drilling for 1978. Lack of technical organization accounted for 50% of the work stoppages, and 40% of the prospecting and drilling flaws was a result of incompetent drilling-rig installation owing to inadequate training of technical field personnel, as well as an inadequate educational program in geophysics and geology.[7]

In 1978, the freight transportation plan (10 ton-kilometers) was fulfilled 99.5% with a 6% increase above that of 1977 and, in 1979, the planned increment was set at 7% over the 1978 level. Significantly, the Prrenjas-Guri-i-Kuq railroad, linking two ferronickel-ore-extracting areas, became operational in 1979, and the construction of the Laç-Shkodër railroad, linking two copper-producing areas, commenced during the same year. Also, in 1978, as part of the construction of the port of Durrës, unofficial sources report the construction of a mineral storage facility.

The 1980 plan envisages a 10.2% increase of industrial output, a 7.6% rise in capital investment, including an 8.5% increase in construction-assembly work over that of the preceding year. The plan calls for the further development of chrome ore and concentrate, ferrochrome, ferronickel, copper and copper manufactures, phosphorites, quartz, and other minerals facilities. This is to be accompanied by the completion and commissioning of new mines and the expansion of existing ones.

Capital construction for 1980 will include the construction of beneficiation plants for chrome (Belqizë) and copper (Korçë and Pukë Districts). In 1980, 23% of the chrome and 62% of the copper ore mined in Albania is scheduled for domestic beneficiation.

Other projects include the addition of a second blast furnace, a second coke battery, and a refractory brick plant at the Steel of the Party metallurgical complex, as well as a fourth turbine generator at the Light of the Party hydroelectric plant. In order to ameliorate the deficit of spare parts, the 1980 plan calls for the output of no less than 95% of the spare parts required by industry.

In 1980, the energy sector—petroleum, gas, coal and electric power—planned to increase 25% over that of 1979.

Preliminary results show unsatisfactory progress in several areas of mineral extracting in 1980, with production schedule lags at the Valias, Alarup, and Memaliaj coal mines, the Belqizë, Batër, and Kalimash chrome mine, and the Spack, Tuc, and Gjegjan copper mines.

PRODUCTION

Albania publishes little in the way of consistent statistics. Most production data is presented as a percentage of growth of output over that of preceding years, or as a percentage of total industrial output, thereby necessitating estimates of annual commodity output.

According to the latest available figures, in 1978 the mineral and related industries are weighed proportionally as a percentage of total industrial output as follows: Machine-building, 12.2%; construction materials industry, 7.9%; copper, 4.2%; electric power, 3.8%; ferronickel, 1.6%; coal, 1.2%; chrome, 1.2%; and the bitumen industry, 0.1%. In 1978, compared with 1960 (base year), key industries such as copper increased production 24 times, chrome 3.5 times, coal 4 times, machine building and electric power 19 and 10.5 times, respectively.[8]

The estimated production of chromite, copper, and nickel for 1978 and 1979 shows marked increase over their respective preceding years. Iron and steel output remained about the same from 1976 through 1977, with an increase only in 1979.

All the nonmetallic minerals except nitrogen, whose output appears to be constant, and mineral fuels show increases during this period.

Table 1.—Albania: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
Asphalt and bitumen, natural[e] [2] thousand tons	1,350	1,500	1,600	1,650
Cement, hydraulic do.	700	750	900	1,000
Chromium: Chromite, gross weight do.	830,000	880,000	990,000	1,110,000
Coal: Lignite[e] do.	975	1,000	1,200	1,400
Copper:				
Mine output, metal content	10,000	10,000	11,500	13,000
Metal, primary and secondary:				
Smelter	9,000	9,000	9,500	11,000
Refined	7,000	7,000	7,000	8,000
Gas, natural, gross[e] [3] million cubic feet	[r]12,370	[r]12,370	12,500	13,000
Iron and steel:				
Iron ore, nickeliferous, gross weight	[r]760,000	760,000	760,000	800,000
Semimanufactures[e]	40,000	40,000	45,000	50,000
Nickel, mine output, metal content	7,000	7,500	8,000	8,500
Nitrogen, N content of ammonia	35,000	35,000	35,000	35,000
Petroleum:				
Crude:				
As reported million tons	1,800	1,900	2,000	2,200
Converted thousand 42-gallon barrels	12,410	12,676	13,344	14,678
Refinery products:[e] [4]				
Gasoline do.	1,360	1,488	1,500	1,600
Kerosine do.	388	465	470	500
Distillate fuel oil do.	1,865	2,238	2,250	2,270
Residual fuel oil do.	2,850	2,330	3,400	3,600
Lubricants do.	84	84	90	100
Other do.	2,100	2,400	2,500	2,600
Total[e] do.	8,647	9,005	10,210	10,670

See footnotes at end of table.

Table 1.—Albania: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
Salt[e]	50,000	50,000	50,000	62,500
Sodium compounds, n.e.s.: Sodium carbonate, calcined (soda ash)[e]	21,000	23,000	25,000	32,500

[e] Estimate. [p] Preliminary. [r] Revised.

[1] In addition to the commodities listed, a variety of crude construction materials (common clay, sand and gravel, and stone) is undoubtedly produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels. Also, metallic nickel production reportedly began in 1978, but data on the level of production are not available.

[2] Includes petroleum refinery-produced asphalt and bitumen.

[3] Separate data on marketable production are not available, but gross and marketed output are regarded as nearly equal.

[4] Based on estimated tonnages reported in: United Nations. World Energy Supplies 1972-76. Statistical Papers, ser. J, No. 21, New York, 1978, 233 pp.

[5] Sums of listed products only; no estimates have been made for other products produced.

TRADE

Albania's foreign commercial policy, predicated upon a domestic and foreign policy of self-sufficiency and total nonalignment, forbids foreign credit borrowing, joint industrial ventures, mixed enterprises, and similar routine international business transactions; it stipulates trade on the basis of import-export only.

Prior to the complete break of trade relations with China in 1978, Albania's principal partner in dollar trade was Yugoslavia, followed by Italy, the Federal Republic of Germany, Greece, Austria, and France. In ruble trade with the planned economy Council of Economic Mutual Assistance (CMEA) countries, Albania's principal trade partner was Czechoslovakia, followed by Romania, the German Democratic Republic, Poland, Hungary, and Belgium.[9]

Since that period, Yugoslavia became Albania's chief trade partner with an approximate $56 million trade turnover in 1979. The rest of the foreign trade slack was taken up by the aforementioned countries.

Yugoslav imports included chromite, bitumen, diesel fuel, chemicals, cement, electric power, and consumer goods. Albania imports metal products, pharmaceuticals, chemicals, refractory materials, and consumer and producer durables from Yugoslavia. Two noteworthy agreements were signed for 1980 with Yugoslavia: A $5,600,000 import-export deal, between Inter-Impeks-Prometi of Skopje and Mineral-Impeksi of Tirana, covering an exchange of mineral commodities (mostly chrome from Albania and a number of metal products from Yugoslavia); and a Yugoslav purchase of 850,000,000 kilowatt-hours of electric energy, which will be transmitted over a 220-kilovolt line that will be built between Fierzë and Kosovo.

Reportedly, Albania plans to increase its exports in 1980 32% over the 1979 level in order to sustain needed purchases of capital equipment and new technology. In 1979, the most important exports were chrome ore, ferronickel ore, petroleum products, coal, and electric power; good export results of blister copper and urea were also achieved that year. In 1980, the export of these commodities is to be expanded together with the export of new products: Cathodic copper, ferrochrome, plastics, etc. Furthermore, the 1980 plan calls for more than 65% of volume of exports to be domestically processed, including 60% of the coal, 23% of the chrome, and approximately 62% of the copper ore.

Albanian chromite, a principal export commodity, is marketed as both a concentrate containing 51% Cr_2O_3 and as ore with a 38% to 42% Cr_2O_3 content. In 1979, Albanian chomite was exported to the German Democratic Republic, Romania, and Poland among the CMEA countries and Yugoslavia; Italy and the United States were among the major importers in the West. The U.S. share of chromite imports amounted to $5,787,178 in 1979; whereas, Albania's main mineral import from the United States during the same year was low-volatile bituminous coal worth $1,196,964.

Albania signed a trade agreement with Romania in July 1979 reportedly to supply Romania with asphalt, petroleum, chrome ore and concentrate, copper and copper products, pyrite concentrate in exchange for machine tools, oilfield equipment, spare parts, chemicals, bearings, etc. A trade agreement was reached that year with the German Democratic Republic calling for Albanian exports of chromite, copper tubes, agricultural and consumer durables in exchange for producer durables, scientific instruments, chemical products, and potash fertilizers. Likewise, an agreement concluded with Turkey in 1979 includes Albanian shipments of petroleum, diesel fuel, urea, sulfuric acid, glycerine, copper, and copper wire in exchange for transport equipment, pump and compressor pipes, aluminum, and cables.

Table 2.—Albania: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum metal including alloys, unwrought	121	40	All to Italy.
Chromium: Chromite thousand tons	256	255	Yugoslavia 127; Poland 37; Czechoslovakia 30.
Copper metal including alloys:			
Unwrought	1,955	3,432	Austria 2,534; Italy 898.
Semimanufactures	--	200	All to Turkey.
Iron and steel metal:			
Steel, primary forms	NA	6,000	All to Philippines.
Semimanufactures:			
Plates and sheets	--	23	All to Italy.
Hoop and strip	--	20	All to Spain.
Platinum-group metals and silver, waste and sweepings value, thousands	$326	$100	All to Italy.
Tungsten ore and concentrate	--	4,004	All to Yugoslavia.
NONMETALS			
Cement	NA	6,154	Egypt 5,000; Yugoslavia 1,127.
Salt	--	3,787	Hungary 2,455; Yugoslavia 1,332.
Sodium compounds, n.e.s.: Soda ash	--	5,209	Italy 3,741; Greece 1,468.
Stone, sand and gravel:			
Dimension stone	277	4,025	Poland 3,296.
Sand	1,017	--	
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	15	515	All to Yugoslavia.
Coke	--	15	All to Finland.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	50	89	All to Italy.
Kerosine do	(2)	(2)	All to Hungary.
Distillate fuel oil do	(2)	(2)	Do.
Residual fuel oil do	NA	17	All to Turkey.
Bitumen and other residues do	1,250	362	Italy 215; Greece 132.
Other do	385	294	All to Poland.

NA Not available.

[1] Owing to the lack of official trade data published by Albania, this table should not be taken as a complete presentation of Albania's mineral exports. Unless otherwise specified, data are compiled from official trade statistics of individual trading partners as well as the United Nations World Trade Annual, v.'s I, II, and III, Walker and Co., New York, 1980.

[2] Less than 1/2 unit.

Table 3.—Albania: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite	--	2	All from Yugoslavia.
Oxide and hydroxide	--	246	Austria 235; West Germany 10.
Metal including alloys:			
Unwrought	607	500	Hungary 492.
Semimanufactures	230	539	Hungary 292; Yugoslavia 152.
Copper:			
Copper sulfate	150	332	All from Yugoslavia.
Metal including alloys:			
Unwrought	176	--	
Semimanufactures	491	565	Italy 386; Japan 125.
Iron and steel metal:			
Pig iron	--	10	All from Italy.
Ferroalloys	2,380	1,960	Yugoslavia 1,945.

See footnotes at end of table.

Table 3.—Albania: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Iron and steel metal —Continued			
Semimanufactures:			
Bars, rods, angles, shapes, sections	44,063	34,724	Poland 19,633; Greece 11,928.
Plates and sheets	19,944	8,593	Poland 4,611; Hungary 2,961.
Hoop and strip	121	438	Greece 356.
Rails and accessories	663	--	
Wire	962	384	Greece 209; Italy 123.
Tubes, pipes, fittings	14,154	19,571	Czechoslovakia 6,000; Italy 4,350; Japan 3,275.
Castings and forgings	13	25	Yugoslavia 23.
Unspecified	18,000	17,000	All from Czechoslovakia.
Lead:			
Oxide	170	--	
Metal including alloys, unwrought	329	144	All from West Germany.
Manganese oxides	130	50	All from Greece.
Nickel metal including alloys:			
Unwrought	--	1	All from Netherlands.
Semimanufactures	7	--	
Titanium oxides	141	--	
Tungsten metal including alloys, all forms kilograms	--	400	All from West Germany.
Zinc:			
Oxide and peroxide	--	46	All from Italy.
Metal including alloys:			
Unwrought	13	41	Do.
Semimanufactures	113	37	All from Yugoslavia.
Other:			
Ores and concentrates	--	70	All from Italy.
Oxides, hydroxides, peroxides of metals	--	1	All from West Germany.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc	--	6	All from Italy.
Grinding and polishing wheels and stones	--	4	All from Greece.
Asbestos	--	1,369	All from Yugoslavia.
Boron oxide and acid	--	7	All from West Germany.
Cement	--	179	Greece 149.
Clays and clay products:			
Crude	--	68	All from France.
Products:			
Refractory	4,052	16,778	Spain 5,048; Poland 3,345; Hungary 2,287.
Nonrefractory	--	35	All from Italy.
Feldspar and fluorspar	NA	2,319	France 2,292.
Fertilizer materials:			
Crude, phosphatic	NA	7,600	All from Egypt.
Manufactured:			
Nitrogenous	--	1	All from West Germany.
Potassic	5,000	2,488	All from Italy.
Ammonia	--	2	All from West Germany.
Magnesite	--	9	Do.
Mica, worked	6	1	Do.
Pigments, mineral: Iron oxides, processed	--	26	Do.
Salt	--	10	Do.
Sodium compounds, n.e.s.: Caustic soda	--	1	Do.
Stone, sand and gravel:			
Dimension stone	--	57	All from Italy.
Quartz and quartzite	--	8	All from West Germany.
Sand	--	755	All from Yugoslavia.
Sulfur:			
Elemental	1,164	--	
Sulfuric acid	5,334	9,135	Greece 7,970; Yugoslavia 1,154.
Talc	70	263	Austria 200.
Other:			
Crude	--	100	All from Greece.
Halogens	--	1	All from West Germany.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	--	23	Do.
Coal: Anthracite and bituminous coal thousand tons	136	168	West Germany 105; United States 63.
Coke do	11	9	All from Poland.
Petroleum refinery products:			
Distillate fuel oil thousand 42-gallon barrels	15	--	
Lubricants do	5	10	Italy 9.
Other:			
Liquefied petroleum gas do	--	([2])	All from West Germany.
Mineral jelly and wax do	--	([2])	All from Italy.

NA Not available.

[1] Owing to the lack of official trade data published by Albania, this table should not be taken as a complete presentation of Albania's mineral imports. Unless otherwise specified, data are compiled from official trade statistics of individual trading partners as well as the United Nations World Trade Annual, v.'s I, II, and III, Walker and Co., New York, 1980.

[2] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Chromite.—Albania's estimated 21.5 million tons of chromite reserves is situated in four main deposits in the eastern regions of the country near the Yugoslav border. The deposits are podiform whose chromium content is estimated to range from tens of thousands to hundreds of thousands of tons of chromium content, with an estimated average 43% Cr_2O_3 content.

The main chromite-producing deposits are in the Tropojë-Kukës area in the northeastern part of the country, containing the Kukës, Krumë, Kalimash, Kam, Tropojë, and Qafa-e-Prushit Mines; the Batër-Martanesh area, in central Albania with the Belqizë, Batër, Klos, Lugu-i-Gjote, and Todo Manco Mines; the Pogradec-Lake Ohrid area, also in central Albania, with the Memelisht, Zergjan, and Pogradec Mines; and the Korcë area, in the south, with the Kruste Mine.

In 1978, Albania reported the discovery of new chrome ore deposits but provided no details regarding location or size of deposits.

Generally, Albania is reported to have exceeded its chrome ore output plans for 1978 and 1979. However, project delays were noted at shafts 3 and 5 at the Belqizë Mine and shaft 6 at the Batër Mine; poor labor organization was given as the reason.

In 1979, it was reported that a chrome ore sorting plant was put into operation in the Batër Mine area and that the construction of sorting plants at Thekë and Shkallë and Belqizë is continuing. Currently, these plants sort 80% of Albania's exported chromite.

Most of Albania's chrome is exported. A small amount is consumed by the domestic refractory industry; however, the largest amount of the mineral, domestically consumed, is used in ferrochrome production. The increase of domestic ferrochrome production capacity with the addition of new plants, such as the one in Burrel, will set aside an estimated 250,000 tons of chromite in 1980 for domestic consumption.

Copper.—Approximately half of Albania's estimated 50-million-ton copper reserves (low-grade sulfide) are located in the Midrite District; the rest are in the Krujë, Kukës, Pukë, and Shkoder areas in the northern part of the country. In 1978, the construction of a new beneficiation plant was reported in Pukë and, in 1979, a small copper-smelting plant in Laç became operational.

Despite estimated increases in the production of ore, blister copper, and semimanufactures in 1978 and 1979, Albania reported decreases in the quality of ore output. The quantity output for January-May 1979 exceeded the plan by 102%; whereas, the planned quality of output was met only 90%, thus raising transportation and blister-processing costs by several million leks.[10] Mine losses of ore of up to 2% and a 7%-above-plan increase in the ore dilution was reported at the Gjergjan Mine in 1978. Similar situations were reported in the Spac, Kurbnesh, Thirra, Derven, and Shmia copper mines.[11]

Reportedly, the Thirra Mine also suffered losses, both in quality and quantity of ore, due to the buildup of large stocks that was caused, in part, by inadequate transportation.

Nickeliferous Iron Ore.—Most of Albania's nickeliferous iron ore is found in deposits in the east-central part of the country. The principal mines are Prrenjas, Cervenake, and Guri-i-Kuq, in the Pogradec area, and Pishkash in Librazhd. Other mines are situated in the Kukës and Dibrë areas at Mamëz and Bushtricë. Reserves are estimated at 20 million tons with an ore content of 15% iron, 1% nickel, and 0.06% cobalt.

Nickel and cobalt are produced as byproducts of iron ore mining in the Librazhd and Pogradec areas, which are reported to contain an estimated 200,000-ton reserve of nickel and a 12,000-ton reserve of cobalt. Reportedly, 36,000 tons of nickel will be produced in 1980.[12]

In 1978, a new Guri-i-Kuq Mine became operational and, the following year, the discovery of new ferronickel deposits were reported. Also in 1978, Albanian authorities reported significant, though unspecified, losses of ore as well as ore dilution at the Prrenjas Mine.

Iron and Steel.—The 1978-79 period witnessed the startup and expansion of the 800,000-ton-per-year designed-capacity steel complex at Elbasan. In 1979, the Prrenjas-Guri-i-Kuq railroad was commissioned, linking the Elbasan complex with two major ore-producing areas. Currently, Albania is exporting some of its iron and steel output to Italy, Spain, and the Philippines.

NONMETALS

Cement.—Albanian cement plants are located along the western part of the country at Elbasan, Fushe-Krujë, Shkodër, Tirana, and Vlorë. Although, a net exporter of cement, Albanian industry often complains of plan nonfulfillments due to a lack of regular supplies of this commodity. Reportedly, in 1980, the output of cement is planned at 1,000,000 tons.

Fertilizer Materials.—Albania is a net importer of raw materials for fertilizer production. Phosphate is imported from North Africa, potash from Italy, and nitrogenous material and ammonia from the Federal Republic of Germany. However, recently phosphorite deposits were found in Gjirokastër, Tepelenë, and Sarande. The production of phosphatic fertilizers at Laç, in Krujë, is in the form of granulated and powdered superphosphate material. Nitrogenous fertilizer is produced at the 50,000-ton-per-year Fier ammonia plant. Urea is also produced in Fier.

The Albanian chemical industry produces sulfuric acid (in Krujë) as well as caustic and calcine soda.

MINERAL FUELS

In 1978 and 1979, Albania maintained its self-sufficiency in all forms of energy, as well as its position as a net exporter of most hydrocarbon fuels and electric power.

In comparison with 1977, the total production of primary energy in 1978 and 1979 increased 7% and 8%, respectively. Also, marked increases occurred during this period in the output of lignite, petroleum, and electric power. Exports of several petroleum products, however, dropped significantly compared with the 1977 level.

Table 4.—Albania: Estimated total primary energy balance for 1978 and and 1979[1]

(Million tons of standard coal equivalent[2])

Year	Total primary energy	Coal (lignite, anthracite, bituminous, and coke)	Crude oil and petroleum products	Natural and associated gas	Hydropower
1978:					
Production	4.49	0.84	2.94	0.47	0.24
Imports	.12	.12	--	--	--
Exports	.24	.01	.17	--	.06
Apparent consumption	4.37	.95	2.77	.47	.18
1979:					
Production	4.96	.98	3.23	.49	.26
Imports	.12	.12	--	--	--
Exports	.27	.01	.19	--	.07
Apparent consumption	4.81	1.09	3.04	.49	.19

[1] Estimates based on data from various Albania sources.

[2] 1 ton of standard coal equivalent (SCE) = 7,000,000 kilocalories. Conversion factors used are: Lignite, 0.7; crude oil, 1.47; natural gas, 1.33 (per 1,000 cubic meters); hydroelectric power, 0.125 (per 1,000 kilowatt-hours).

Source: United Nations. World Energy Supplies. Statistical papers, Series J, No. 18, 1975.

Hydroelectric power output continued to increase steadily during 1978 and 1979 with the startup of the Fier powerplant and the expansion of generating capacity at the Light of the Party plant. Consumption of all forms of energy during this period increased substantially, matching Albania's accelerated effort to industrialize its economy.

Coal.—Albanian lignite deposits are located in four main areas of the country: Near Durrës, in the central coastal area; near Krrabë, in the central part of the country; in the south at Memaliaj; and in the southwest in the Korcë area.

In 1978 and 1979, lignite production represented approximately 18% of Albanian total primary energy output. During this period, the Valias Mine became operational, and the Manzë Mine near Durrës was reported to have increased its capacity and efficiency.

Petroleum.—Albania's petroleum output increased slightly in 1978 and substantially over the 1978 level in 1979. Although new but unspecified reserves were reported in 1979, Albania's main known oilfields are located in the southeastern part of the country in the Patos, Marineze, and Stalin areas.

The startup in 1978 of the 1-million-ton-per-year Ballësh refinery near the Patos oilfield and Albania's additional 1-million-ton-per-year refining capacity and reserves should be sufficient for domestic consumption and export in the 1980's.

Natural Gas.—As with crude oil, new but unspecified gas deposits were discovered in Albania in 1979, adding to reserves estimated at 8 billion cubic feet.

Most of Albania's gas deposits, as with petroleum, are found in the Lushnje and Fier areas. Albanian natural gas is consumed domestically by the chemical and petrochemical sectors of the economy as well as by thermal-power-generating plants.

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[1] Translator, Branch of Foreign Data.

[2] Zeri I Popullit (Tirana). On the Fulfillment of the State Planned Budget for 1979 and On the Draft State Plan and Budget for 1980. Feb. 12, 1980, pp. 1-3.

[3] Work cited in footnote 2.

Hanku, R. (Minister of the Construction Industry). The Construction Workers Will Strive Diligently To Perform Great Tasks for 1979 in time, With Good Quality and Low Cost. Bashkimi (Tirana), Dec. 31, 1978, pp. 1-2.

[4] Adami, T. The Development of the Machine Industry - A Powerful Support for the Other Branches of the Economy. Rruga & Partise (Tirana), March 1978, pp. 48-57.

Zeri I Popullit, Editorial, (Tirana), July 25, 1979, pp. 1, 3.

[5] Bashkimi (Tirana), July 19, 1978, p. 2.

[6] Zeri I Popullit (Tirana), Nov. 1, 1979, p. 2.

[7] Papa, K. The Fulfillment of Tasks in the Petroleum Industry Requires the Rigorous Implementation of Scientific Discipline. Rruga & Partise (Tirana), February 1979, pp. 6-14.

[8] Islami, F. and N. Hoxha. Socialist Industrialization - A Necessity for a Uninterrupted and Independent Development on the Road to Socialism. Rruga & Partise (Tirana). No. 11, November 1979, pp. 14-15.

[9] Council for Mutual Economic Assistance (CMEA). Founded in January 1949. The founding members were Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and the U.S.S.R. Albania joined in February 1949, but ceased to take part in meetings in 1961. The German Democratic Republic (East Germany) was admitted in 1950, Mongolia in 1962, Cuba in 1972, and Vietnam in 1978. Yugoslavia obtained permanent observer status in 1965.

[10] Zeri I Popullit (Tirana). No Concession on the Fulfillment of Tasks in Mines. June 29, 1979, p. 1.

On Nov. 28, 1979, lek4.66=US$1.00.

[11] Dede, T. and V. Tahsimi. The National Exploitation of Mineral Ores Increases Their Value. Zeri I Popullit (Tirana), Jan. 30, 1979, p. 3.

[12] Metal Bulletin Monthly. Albania: Chrome's Mining Mystery. Nov. 1, 1979, p. XXXIX.

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The Mineral Industry of Algeria

By David E. Morse[1]

Algeria was one of Africa's largest producers of crude petroleum, natural gas, cement, marble, and barite in 1978 and 1979 and was the only producer of primary mercury on the continent. Production of zinc, lead and copper concentrates, iron ore, phosphate rock, clay minerals, gypsum, and salt was modest by world standards. The State-owned Société Nationale de Recherches et d'Exploitations Minieres (SONAREM) controlled mineral exploration, production, processing, and marketing in Algeria. Exploration for and exploitation of liquid and gaseous hydrocarbons in Algeria was dominated by the State-owned Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocabures (SONATRACH). Natural gas was marketed and distributed to domestic consumers by Société Nationale Algerienne de Electricité et du Gaz (SONELGAZ).

The Algerian economy continued to expand in both 1978 and 1979; there was an overall growth in the gross domestic product (GDP) of approximately 9% in both 1978 and 1979 in constant 1974 prices. Algeria's 1978 GDP, in terms of then-current prices, was $21.8 billion;[2] in 1979, the GDP rose to an estimated $27.1 billion in 1979. The hydrocarbon sector continued to be the backbone of the Algerian economy and the largest contributor to Government revenues in 1978 and 1979.

Recent development plans have placed emphasis on the development of hydrocarbons and heavy industry. With 40% to 50% of the GDP earmarked for investment each year, over 250 factories were opened and 150 infrastructural projects were completed in the 1970-77 period. As a result, many basic industries were brought online, making Algeria almost self-sufficient in fertilizers, cement, chemicals, iron and steel, and plastics. However, most industries established so far have been capital intensive rather than labor intensive; consequently, unemployment and underemployment have become serious problems for unskilled workers. Coincidentally, a chronic shortage of skilled manpower has been responsible for underutilization of the country's industrial capacity. A rapid population growth of over 3% per year in the decade of the 1970's raised domestic consumption and has placed a severe strain on Algeria's neglected agriculture, housing, and services sectors.

Algeria's second 5-year development plan ended in 1977, and 1978 was declared a year of consolidation, with emphasis placed on the completion of many planned projects. However, the President's deteriorating health and subsequent death in December 1978 delayed promulgation of the third development plan. When the new plan was made known, it was announced that it would cover the 1980-84 period.

Government investment levels remained high in both 1978 and 1979, but the 1979 development budget emphasized education, community development and urban modernization, housing, and water projects. Allotments for industrialization continued at a fairly high level, with important investments in the cement, fertilizer, iron and steel, and nonferrous metals industries. SONATRACH was investing in new petroleum refineries, liquified natural gas (LNG) plants, natural gas processing and reinjection facilities, natural gas and crude oil pipelines, and new oil and gas production wells, and was also conducting a moderately extensive exploration program. SONAREM was conducting exploration programs in the remote Hoggar mountains in southern Algeria and in the high plateau region as well.

PRODUCTION AND TRADE

Algerian mineral production has remained fairly stable for several years, but output has declined in some areas as exploration and development have failed to keep pace with the exhaustion of some mines. Crude petroleum production in 1978 and 1979 was fairly constant, but natural gas and natural gas liquids output increased substantially. Cement output increased markedly as new cement plants were brought online in both 1978 and 1979. Barite production recovered from the low level of 1977, but lead-zinc output remained depressed, and iron ore production did not meet SONAREM's projected levels owing to poor world market conditions. Mining and quarrying contributed less than 1% to the GDP in both 1978 and 1979, whereas the contribution to the GDP from the hydrocarbon sector was about 28% in 1978 and nearly 31% in 1979.

Algeria exported significant quantities of crude petroleum, petroleum products, LNG, iron ore, mercury, and phosphate rock in 1978 and 1979. Minor quantities of lead and copper concentrates were also exported. The United States imported 233.8 million barrels of Algerian crude oil in 1978 and 217.8 million barrels in 1979. This oil represented over 50% of all Algerian output and 10.2% of all U.S. crude imports in 1978 and 9.35% of U.S. crude imports in 1979. The U.S. imported 63 billion cubic feet of natural gas from Algeria in 1978 and nearly 264 billion cubic feet in 1979. Although Algerian crude oil exports declined by 2.8% in 1979, compared with 1978, the average value of these exports in 1979 increased by 49%; and by yearend 1979, their f.o.b. value was more than double the 1978 average of $14.12 per barrel.

The value of exported crude oil, refined petroleum products, and LNG was $6.2 billion in 1978 and nearly $8.2 billion in 1979, or nearly 92% of the value of Algeria's total exports in both years. Nonhydrocarbon mineral exports were valued at an estimated $45 million in 1978 and $47 million in 1979.

Table 1.—Algeria: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Copper concentrate:				
Gross weight	[e]1,600	1,500	679	2,150
Metal content	[e]370	345	157	500
Iron and steel:				
Iron ore, gross weight thousand tons	2,800	3,182	3,052	3,050
Metal:				
Pig iron do.	455	429	200	200
Crude steel do.	356	400	400	363
Semimanufactures do.	[e]171	NA	NA	NA
Lead concentrate:				
Gross weight	3,000	1,362	2,837	3,000
Metal content	2,100	875	1,825	2,100
Mercury 76-pound flasks	[r]30,915	30,429	30,603	30,000
Silver[e] thousand troy ounces	80	40	75	100
Zinc:				
Concentrate:				
Gross weight	[r]14,283	5,762	9,981	12,500
Metal content	[r]6,856	2,748	4,790	6,000
Metal, smelter	20,000	20,000	25,700	17,000
NONMETALS				
Barite, crude	75,000	48,066	73,087	90,000
Cement, hydraulic thousand tons	1,400	1,777	2,697	3,600
Clays:				
Fuller's earth	[r]3,200	4,367	4,847	5,000
Kaolin	[r]7,784	11,465	17,423	18,100
Bentonite	[r]24,514	24,400	35,664	36,500
Diatomite	[r]4,321	4,100	4,025	4,000
Gypsum and plasters[e] [2] thousand tons	175	175	175	191
Lime, hydraulic do.	[r]33	40	[e]50	82
Phosphate rock do.	[r]742	1,173	1,136	1,072
Salt do.	136	147	171	165
Sodium compounds: Caustic soda	[r]696	688	[e]700	700
Strontium minerals: Celestite, gross weight	[r]6,483	5,100	5,822	5,400
Sulfur, elemental[e]	9,876	10,000	15,000	15,000

See footnotes at end of table.

Table 1.—Algeria: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS				
Coal thousand tons	[e]1	--	--	--
Gas, natural:				
Gross million cubic feet	863,051	939,118	1,148,322	1,400,000
Marketed (including liquefied) do	350,779	305,223	490,095	725,000
Natural gas plant liquids (condensate)[e] thousand 42-gallon barrels	18,000	20,800	32,200	55,000
Petroleum:				
Crude[3] do	383,816	409,864	423,838	425,000
Refinery products:				
Gasoline do	6,893	6,690	7,064	7,000
Jet fuel and kerosine do	3,144	3,101	2,736	2,700
Distillate fuel oil do	10,580	10,079	11,041	11,000
Residual fuel oil do	9,222	7,266	7,792	7,300
Lubricants do	128	228	362	400
Other do	6,522	9,536	11,937	10,500
Refinery fuel and losses do	894	904	1,035	1,100
Total do	37,383	37,804	41,967	40,000

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, secondary aluminum, secondary lead, and secondary copper may be produced in small quantities, and other crude construction materials (other clays and stone) presumably are produced for local consumption, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] Includes approximately 50,000 tons of plasters each year.

[3] Includes lease condensate.

Table 2.—Algeria: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS			
Aluminum metal including alloys, all forms	363	585	France 459; Belgium-Luxembourg 126.
Copper:			
Ore and concentrate	1,337	1,000	All to Bulgaria.
Metal including alloys, all forms	2,781	4,489	France 4,020; Belgium-Luxembourg 469.
Iron and steel:			
Ore and concentrate thousand tons	1,734	1,434	Belgium-Luxembourg 800; Italy 238; Romania 160.
Metal:			
Scrap	113,906	74,246	Spain 53,097; Italy 21,000.
Pig iron, ferroalloys, similar materials	106,365	95,147	Italy 37,962; France 30,100; China, mainland, 20,985.
Sponge iron, powder, shot	1,930	--	
Semimanufactures	35,147	38,811	Mainly to Italy.
Lead:			
Ore and concentrate	4,555	2,682	Tunisia 1,682; Spain 1,000.
Metal including alloys, scrap	1,200	790	Mainly to Belgium-Luxembourg.
Mercury 76-pound flasks	[r]31,938	7,873	United States 3,602; West Germany 2,813.
Nickel metal including alloys, all forms	50	20	All to France.
Zinc:			
Matte	125	523	France 323; Belgium-Luxembourg 200.
Metal including alloys, all forms	6,325	84	France 66; Belgium-Luxembourg 18.
Other:			
Ash and residue containing nonferrous metals	142	477	France 256; Belgium-Luxembourg 220.
Metals including alloys, all forms	30	20	All to Belgium-Luxembourg.
NONMETALS			
Abrasives: Grinding and polishing wheels and stones kilograms	(3)	1,000	All to France.
Clays, crude:			
Kaolin and bentonite	469	150	All to Tunisia.
Other	250	--	
Diatomite and other infusorial earth	850	796	France 596; Belgium-Luxembourg 200.
Fertilizer materials:			
Crude, phosphatic	555,290	775,501	Italy 190,317; Czechoslovakia 108,707; Poland 97,350.
Ammonia	8,046	--	
Gypsum and plasters	19	20	France 10; Switzerland 10.
Pyrite, unroasted	42,870	--	

See footnotes at end of table.

Table 2.—Algeria: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
NONMETALS —Continued			
Salt	21,298	4,400	Bénin 3,400; Ivory Coast 1,000.
Other:			
Crude	2,600	5,363	U.S.S.R. 3,400; Italy 1,962.
Slag, dross, and similar waste, not metal bearing	25,985	--	
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural, liquefied million cubic feet	234,756	175,112	France 107,270; United Kingdom 35,395.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	332,162	363,565	United States 203,843; West Germany 58,094.
Refinery products:			
Gasoline do	4,524	3,122	Netherlands 1,459; Belgium-Luxembourg 936; Bénin 411.
Jet fuel and kerosine do	733	805	Netherlands 337; Bénin 272.
Distillate fuel oil do	1,655	787	Bénin 507; Greece 89.
Residual fuel oil do	6,291	15,153	United States 3,861; Italy 252; Greece 143.
Total do	13,203	19,867	

[r] Revised.

[1] Less than 1/2 unit.

Table 3.—Algeria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS			
Aluminum:			
Bauxite	--	9,550	All from Peru.
Oxide and hydroxide	92	248	France 165; West Germany 71.
Metal including alloys, all forms	6,797	10,173	U.S.S.R. 1,889; Belgium-Luxembourg 1,401; West Germany 1,154; France 1,133.
Antimony metal including alloys, all forms	30	115	Netherlands 80; Belgium-Luxembourg 29.
Arsenic oxide and acid	50	80	All from France.
Chromium oxide and hydroxide	2	19	West Germany 11; France 4; Belgium-Luxembourg 3.
Cobalt oxide and hydroxide	(1)	(1)	All from Spain.
Copper:			
Copper sulfate	1	19	Italy 10; West Germany 8.
Metal including alloys, all forms	9,885	12,391	West Germany 4,445; Belgium-Luxembourg 3,263; Italy 2,405.
Iron and steel metal:			
Scrap	11	12	United States 7; France 4.
Pig iron, ferroalloys, similar materials	[r]12,104	11,252	Canada 3,000; Brazil 2,958; France 1,946.
Steel, primary forms	[r]22,936	206,972	West Germany 70,451; Japan 69,183; Belgium-Luxembourg 1,929.
Semimanufactures	[r]815,290	994,480	Italy 213,382; Spain 208,906; Belgium-Luxembourg 126,687; West Germany 106,415.
Lead:			
Oxides	1,640	1,052	West Germany 948; Austria 100.
Metal including alloys, all forms	4,120	4,098	West Germany 1,875; Tunisia 1,425; Belgium-Luxembourg 511.
Magnesium metal including alloys, all forms	(1)	5	France 2; Switzerland 2.
Manganese oxide	562	2,232	West Germany 849; Greece 575; Belgium-Luxembourg 458.
Mercury 76-pound flasks	146	5	U.S.S.R. 4.
Nickel metal including alloys, all forms	77	118	United States 42; France 33; West Germany 26.
Platinum-group and silver metals including alloys:			
Platinum-group troy ounces	1,736	2,186	United Kingdom 1,190; United States 514; France 482.
Silver do	10,835	358,545	France 309,225; Belgium-Luxembourg 32,151.
Rare-earth metals:			
Oxides	1	3	Mainly from Italy and Spain.
Metals including alloys, all forms	(1)	10	Mainly from West Germany.
Tin metal including alloys, all forms	82	63	Belgium-Luxembourg 26; Bolivia 20; France 12.

See footnotes at end of table.

Table 3.—Algeria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS —Continued			
Titanium:			
Ore and concentrate	462	277	All from Australia.
Oxide	1,883	3,026	West Germany 2,188; United Kingdom 802.
Tungsten metal including alloys, all forms	1	1	Mainly from France, Switzerland, and United States.
Zinc:			
Ore and concentrate	12,581	20,000	All from Peru.
Oxide	472	358	France 135; West Germany 131.
Metal including alloys, all forms	501	684	West Germany 402; France 200.
Zirconium ore and concentrate	4	10	All from France.
Other:			
Ores and concentrates	(1)	1	Mainly from United States.
Oxides, hydroxides, and peroxides of metals	266	324	Spain 316.
Metals including alloys, all forms:			
Metalloids	57	100	Italy 81; West Germany 17.
Pyrophoric alloys	(1)	3	Mainly from China, mainland.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	39,920	60,915	Italy 45,991; Greece 14,815.
Grinding and polishing wheels and stones	634	1,016	Italy 486; France 231; Switzerland 134.
Dust and powder of precious and semiprecious stones	(1)	--	
Asbestos	11,852	15,872	Canada 9,965; Botswana 3,095; United States 1,425.
Barite and witherite	45,100	67,388	Italy 54,048; Spain 7,050.
Boron materials:			
Crude natural borates	26	65	Mainly from Italy.
Oxide and acid	264	236	Italy 207; France 21.
Bromine	(1)	(1)	All from Italy and France.
Cement thousand tons	2,130	2,190	Spain 1,043; Greece 500; U.S.S.R. 207.
Chalk	10,676	7,359	France 6,004; Italy 562.
Clays and clay products (including all refractory brick):			
Crude:			
Kaolin	12,769	12,393	United Kingdom 9,945; West Germany 1,264.
Other	5,497	4,588	U.S.S.R. 1,713; France 1,025; Spain 600.
Products:			
Refractory (including nonclay brick)	49,178	45,301	U.S.S.R. 23,058; West Germany 6,785; France 4,275.
Nonrefractory	4,228	1,399	West Germany 508; France 393; Spain 313.
Diamond, industrial thousand carats	8,030	525	France 350; Zaire 175.
Diatomite and other infusorial earth	75	56	France 25; Belgium-Luxembourg 23.
Feldspar	1,371	2,585	Italy 1,535; West Germany 940.
Fertilizer materials:			
Crude and manufactured:			
Nitrogenous	127,288	87,454	Poland 42,033; Bulgaria 30,353.
Phosphatic	74,329	40,321	Romania 20,321; Tunisia 20,000.
Potassic	37,728	78,535	Italy 46,835; Spain 31,700.
Other, including mixed	62,212	21,523	Spain 13,655; Italy 7,863.
Ammonia	26,305	119,872	Iran 21,684; United Kingdom 15,994; West Germany 7,739.
Fluorspar	118	535	Mainly from West Germany.
Graphite, natural	122	472	West Germany 253; U.S.S.R. 175.
Gypsum and plasters	1,168	4,480	France 2,238; Spain 1,750.
Iodine	(1)	(1)	All from France and West Germany.
Lime	4,456	2,714	Spain 1,081; Belgium-Luxembourg 816.
Magnesite	313	422	Mainly from Austria.
Pigments, mineral:			
Natural, crude	510	649	Mainly from France.
Iron oxides, processed	513	573	West Germany 453; France 89.
Salt and brines	13	47	Mainly from West Germany.
Sodium and potassium compounds, n.e.s.	14,466	19,234	Italy 13,399; Romania 2,999; France 1,744.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	49	45	Italy 22; France 15.
Worked	82	37	Mainly from West Germany.
Dolomite, chiefly refractory grade	480	3,143	Spain 1,600; Switzerland 1,168; West Germany 278.
Gravel and crushed rock	3,261	920	Italy 688; West Germany 139.
Quartz and quartzite	780	1,486	France 844; West Germany 377.
Sand, excluding metal bearing	3,071	2,515	Belgium-Luxembourg 1,603; United States 605.

See footnotes at end of table.

Table 3.—Algeria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
NONMETALS —Continued			
Sulfur:			
Elemental:			
Other than colloidal	28,940	87,870	Poland 58,720; Canada 15,150; United States 10,250.
Colloidal	10,804	19,238	Spain 15,040; France 4,098.
Sulfur dioxide	489	246	Mainly from Spain.
Sulfuric acid	50,583	25	Switzerland 16; France 6.
Talc, steatite, soapstone, pyrophyllite	2,824	5,068	France 2,647; United Kingdom 2,060.
Other:			
Crude:			
Vermiculite, perlite, chlorite	465	9	Mainly from France.
Other	(1)	38	Mainly from West Germany.
Oxides and hydroxides of magnesium, strontium, barium	4	18	France 6; Japan 6; West Germany 5.
Fluorine, elemental	1	(1)	All from France.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	13	Mainly from France.
Carbon black	2,245	2,960	Netherlands 1,185; United Kingdom 1,070.
Coal, all grades, including briquets	22,511	49,926	U.S.S.R. 41,164; West Germany 5,750.
Coke and semicoke	216,688	186,229	West Germany 85,486; Italy 48,890; U.S.S.R. 41,476.
Hydrogen, helium, rare gases	116	373	France 280; United Kingdom 78; Japan 14.
Petroleum:			
Crude thousand 42-gallon barrels	(1)	(1)	All from United States.
Refinery products:			
Gasoline do	39	877	Italy 707; France 152.
Jet fuel and kerosine do	(1)	45	Italy 40.
Distillate fuel oil do	565	854	Italy 259; Spain 218; Romania 217.
Residual fuel oil do	623	1,071	Romania 354; Italy 311; U.S.S.R. 133.
Lubricants do	565	274	United Kingdom 248.
Other:			
Liquefied petroleum gas do	576	1,526	Saudi Arabia 369; Italy 293; Kuwait 263.
White spirit do	30	34	All from Netherlands.
Petroleum jelly and wax do	21	61	West Germany 59.
Asphalt and bitumen do	384	486	Spain 215; Italy 186.
Petroleum coke and flux do	(1)	(1)	All from France.
Unspecified do	15	15	United Kingdom 7; Bahamas 4.
Total do	2,818	5,243	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,709	2,744	West Germany 1,155; Italy 1,014; France 564.

[r] Revised.

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—Algeria planned to bring its first aluminum smelter online in 1982 at Msalla in the Setif district of north-central Algeria. The 125,000-ton-per-year facility was expected to be built with financial and technical assistance provided by the U.S.S.R. Plans called for the importation of alumina for the smelter from Jamaica. In February 1979, SONALGAZ awarded a $150 million contract to Thomassen Holland B. V. of the Netherlands for a 550-megawatt gas-turbine electric power plant that was expected to furnish electricity for the aluminum smelter. The first units of the powerplant were scheduled to come online in 1981 with final completion scheduled for 1983.

Bauxite.—SONAREM retained Geomines Geological and Mining Engineering Corp. of Hungary to explore for bauxite in northern Algeria. No details of the $100,000 contract were disclosed.

Iron Ore.—Most of Algeria's 1978 and 1979 iron ore output came from the Oenza and Boukhadra operations in eastern Algeria. Domestic demand for iron ore was 900,000 tons per year, and the remainder of the production was exported to markets in Europe.

The Gara Djebilet iron ore deposits in

western Algeria have been studied extensively, and SONAREM, in conjunction with Société Nationale de Siderurgie (SNS), planned to begin exploitation of the 1-billion-ton deposits by 1985. An engineering study was begun in 1978 for a 1,500-kilometer railway from the Gara Djebilet deposits to La Macta near Oran on the Mediterranean Sea, where SNS planned to build a 10-million-ton-per-year fully integrated steel complex based on domestic ores. Bechtel Inc. of the United States was awarded a $33.5 million contract in 1978 for a 3-year study covering all phases of the project other than design of the steelworks. In 1979, Tiajpromexport of the U.S.S.R. received an $8.7 million contract for a feasibility study on development of the Gara Djebilet iron ore deposits.

Iron and Steel.—The expansion of the El Hadjar steel mill continued in 1978 and 1979, with the objective being to increase the mill's capacity from 450,000 tons per year of raw steel to 2 million tons per year. New facilities included a 2,000-cubic-meter blast furnace, a $54 million bank of coke ovens, three 85-ton Linz-Donawitz (LD) converters, two single-strand continuous casters, and a rod wire mill. The mill's hot-rolling capacity was projected at 1.3 million tons per year after the expansion, and its cold-rolling capacity was projected at 700,000 tons per year. The investment for the project, excluding the coke ovens, was $500 million. Japan's Kawasaki Heavy Industries, Ltd., C. Itoh & Co., and West Germany's Demag A.G. were scheduled to complete the expansion by 1983.

SNS planned to build a new iron and steel production facility at Jijel, 12 kilometers east of Djidjelli on the Mediterranean coast, in 1984. The project plans included facilities for production of 1.2 million tons per year of sponge iron using direct-reduction electric steelmaking furnaces with continuous casters capable of producing 800,000 tons per year of steel billets and a 110,000-ton-per-year ferroalloys plant. It was anticipated that domestic natural gas would be used as the reductant. Construction of a new power station to supply electricity for the mill was also planned; and construction of a new port, road and rail connections, and a town for the mill's employees was also required.

Manganese.—SONAREM continued to investigate manganese deposits at Guethara in western Algeria in 1978 and 1979. The deposits were expected to be exploited to produce 10,000 to 12,000 tons per year of manganese ore for use by the domestic steel industry.

Other Metals.—SONAREM continued to assess the mineral potential of the Ahaggar massif and the Hoggar mountains in the remote desert regions of southern Algeria. Deposits slated for development were gold at Tirhirine, uranium at Tingouine and Abankor, and tungsten at Laouni.

NONMETALS

Cement.—Algeria's State-owned construction materials cooperation, Société Nationale des Matériaux de Construction (SNMC), was in the midst of an expansion program that aimed to increase the Nation's annual cement capacity to over 10 million tons. Three cement plants were completed in 1978, a 1-million-ton-per-year plant at Ain-El-Mebira, a 1-million-ton-per-year plant at Beni Saf, and a 500,000-ton-per-year plant at Saida. In 1979, two plants were projected to be completed, one at Hamma Boziane and one at El Asnam. Three cement plants were scheduled to be commissioned in 1980, a 1-million-ton-per-year plant at Bouira, a 500,000-ton-per-year plant at Batma, and a 500,000-ton-per-year plant at Djelfa. In 1979, SNMC awarded two contracts valued at approximately $240 million each for the construction of two plants. Two Japanese firms, Marubeni Corp. and Kawasaki Heavy Industries, Ltd., were retained to build a 1-million-ton-per-year cement works at Tebessa; and F. L. Smidth-France and F. L. Smidth-Denmark were contracted to construct a 1-million-ton-per-year facility on a turnkey basis at Sour-El-Ghozlane in the Bouira governate, 100 kilometers south of Algiers.

Fertilizer Materials.—Nitrogenous.—In 1978, SONATRACH awarded a $50 million contract to Techniq and Creusot Loire Enterprises of France to modernize and expand output from the Arzew fertilizer plant. The French companies were also contracted to provide technical assistance to increase the operating efficiency of the plant's four production units. Output from the Arzew plant, which was completed in 1970, has not even come close to the design capacity of 330,000 tons per year ammonia, 130,000 tons per year urea, 165,000 tons per year ammonium nitrate, and 132,000 tons per year nitric acid. An expansion program was also underway at the Arzew fertilizer facility to increase ammonia capacity by 300,000 tons per year and ammonium nitrate capacity by 330,000 tons per year. At SONA-

TRACH's Annaba fertilizer complex, construction of new units to produce 300,000 tons per year of ammonia, 330,000 tons per year of ammonium nitrate, and 195,000 tons per year of nitric acid was also underway.

Phosphatic.—In January 1979, two Japanese firms, Marubeni Corp. and Hitachi Shipbuilding and Engineering Co., and the Polish State company, Polimex-Cekop, were contracted by SONATRACH to build two phosphate fertilizer complexes in Algeria. The contract was for the expansion of facilities at Annaba and a new plant at Tebessa. Under the contract, a 528,000-ton-per-year sulfuric acid plant and a 500-ton-per-day phosphoric acid plant were to be built at each location. Additionally, Annaba was scheduled to receive units for the production of 231,000 tons per year of diammonium phosphate and 198,000 tons per year of ammonium phosphate. Other units, scheduled to be built at the Tebessa complex, included a 280,000-ton-per-year triple superphosphate plant and a 5,000-ton-per-year aluminum fluoride facility. Plans were for sulfur to be imported and domestic phosphate rock from Djebel Onk to be supplied by SONAREM.

MINERAL FUELS

Natural Gas.—SONATRACH was in the early stages of a massive expansion program to develop the full spectrum of facilities required to produce 3.88 trillion cubic feet per year of natural gas and 250 million barrels per year of natural gas liquids. In 1978, Algerian LNG capacity increased to 600 billion cubic feet (17 billion cubic meters) with the completion of LNG-1 at Bettioua near Arzew and Train 4 at Skikda-1. LNG-2, adjacent to Liquefaction Plant LNG-1, was scheduled to come online in 1980 and was expected to produce 370 billion cubic feet per year (10.5 billion cubic meters) of LNG, 300,000 tons per year of butane, 350,000 tons per year of propane, and was also expected to have helium production capabilities. Trains 5 and 6 at Skikda-1 were also scheduled to come online in 1980 and were expected to bring the capacity of Skikda-1 to 304 billion cubic feet (8.6 billion cubic meters) per year. Contracts for major components and engineering services for LNG-3 at Arzew were awarded by SONATRACH in 1978 and 1979. LNG-3 was scheduled to come online in 1982 and was expected to process 556 billion cubic feet (15.75 billion cubic meters) per year for LNG production and produce 500,000 tons per year of propane and 450,000 tons per year of butane.

Additionally, pipelines from the prolific Hassi R'Mel field to Skikda and Arzew were being built, and construction of the Trans-Med-Pipeline to Italy got underway in 1978. Gas processing plants at Hassi R'Mel were completed and others were under construction there. Development contracts for the Alrar and Rhourde Nouss gas fields were signed in 1979.

Algeria had by yearend 1979 negotiated contracts for the annual export of 1.8 trillion cubic feet of natural gas as LNG and 438 billion cubic feet of natural gas through the Trans-Med-Pipeline, with most deliveries scheduled to begin in the 1980-85 period. In 1979, LNG exports were estimated at 441 billion cubic feet, reflecting an increase of nearly 200 billion cubic feet over 1978 exports. Algerian domestic demand for natural gas expanded rapidly in 1978 and 1979, increasing by 21% in 1978 and by an estimated 11% in 1979.

Petroleum.—Crude petroleum production in Algeria was fairly constant in 1978 and 1979, averaging approximately 1.16 million barrels per day. Algerian crude oil output was expected to peak at 1.25 million to 1.3 million barrels per day in the early to mid-1980's and then decline to approximately 850,000 barrels per day by 1990. Crude petroleum exports were projected to decline sharply beginning in 1980, when the new 300,000-barrel-per-day oil refinery at Skikda is scheduled to be placed in service. SONATRACH planned to decrease 1980 crude oil exports by 150,000 barrels per day and 1981 crude oil exports by an additional 150,000 barrels per day. Exports of refined products were expected to increase significantly but then decline as a result of anticipated increases in domestic demand that would absorb the excess in refined output. Two smaller oilfield refineries at In Amenas and Hassi Massaoud were also scheduled to come online in 1980.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Algerian dinars (AD) to U.S. dollars at the rate of AD3.8345=US$1.00 in 1978 and AD3.755=US$1.00 in 1979.

The Mineral Industry of Angola

By Janice L. W. Jolly[1]

In 1978, petroleum receipts accounted for about 70% of the Angolan Government revenues. The public enterprise Sociedade National de Combustiveis de Angola (SONANGOL), which was formed in May 1976, continued to supervise all aspects of petroleum and other hydrocarbon exploration, extraction, refining, and distribution. As a result of a new law providing for production sharing and a more favorable attitude towards foreign investment, several new petroleum exploration and production contracts were signed in 1979. Several Western nations were, in general, showing a renewed interest in Angolan minerals. The diamond industry was reorganized, and new expatriate help was recruited in an effort to increase production to prewar levels. Cement was exported for the first time since 1975, and Angolan quartz was finding an expanding market.

The economy was still recovering from the dramatic contraction of activity following the exodus of Portuguese authority in 1975 and the devastation caused by protracted civil war between rival independence movements. Much remained to be accomplished, particularly in respect to renovating and improving vital infrastructure, such as the Benguela railroad, and industries, such as the cement and steel industries. A new foreign investment law was introduced enabling foreign private capital to participate in the economic recovery. The agricultural sector was still the largest employer, but it was the petroleum industry that was providing needed funds for economic recovery. The 1977 gross domestic product (GDP) was estimated at $1.97 billion[2] at current prices;[3] this compares with the 1973 GDP of $1.8 billion. Prior to 1975, crude petroleum and coffee dominated exports, each accounting for roughly 30% of the total; diamonds contributed 10% and iron ore a further 6%. In 1978 and 1979, petroleum accounted for most of the revenues earned and iron ore was not being produced.

The first clear step to bring foreign investors back to Angola was the publication of a new investment law, which covers all aspects of economic activity apart from the oil industry. The law allowed for repatriation of profits, provided guarantees of compensation in case of nationalization, and held out the prospect of exemption from tax and from custom duties. A major provision was that the projects must be framed in terms of the country's national development plan. The Government would retain control over accounts and personnel training programs. Foreign capital may not be invested in certain strategic areas of state control, such as defense, banking, insurance, communications, electricity, and water supply. A normal time scale of 10 to 15 years would be established for investment projects. Both joint (where the Government owns 51%) and wholly owned private enterprises will be allowed.[4]

A new mining law was also approved in May 1979. The law spelled out the following principles: (a) Government ownership of all mineral resources; (b) Government control of geological mapping; (c) Government control of mineral resource evaluation; (d) utilization of mineral resources as required by the planned economy; (e) concession of exploration rights exclusively to Government mining enterprises, with some justifiable exceptions; (f) acceptability of operating contracts with certain approved foreign agencies with technical capacity to develop the extraction industry; and (h) foreign companies were obligated to abide by Angolan law and comply with needs of the Angolan people, but at the same time were allowed the right to investment recovery and profits.[5]

The first Council of the General Directorate of the National Directorate of Geology and the Mining Industry met in August 1979 to make plans for the future. It was resolved to speed the reorganization of the diamond industry, to provide the National Enterprise for Ground Waters (HIDROMINA) with manpower and material for supplying the arid and semiarid regions of the country with water, to strengthen the National Gemstone Enterprise (ROREMINA), and to create favorable conditions for exploitation of ferrous metals. The national companies to exploit quartz and phosphate (the Angola State Phosphates Company) were also discussed, as was the establishment of a professional training center for geological and mining industry workers.[6]

Angola signed a number of economic, aid, and cooperation agreements during 1978 and 1979. These included additional cooperation agreements with the Soviet Union and Cuba. In 1976, Angola became the second African country to participate in the Soviet-led Council for Economic Mutual Assistance (COMECON), and a 23-year agreement was signed to broaden contacts with the U.S.S.R. at all levels. Soviet experts were to undertake research on Angola's mineral resources and were to make a geological map of Angola. Accords were also signed with Yugoslavia, Bulgaria, and Brazil for economic, scientific, and technical cooperation. Economic cooperation with Sweden was to be increased. East Germany made two economic agreements for the supply of German equipment. The European Economic Community was considering reconstruction aid for Angola. An agreement was reached with Romania for $74 million in technical and economic aid. The People's Republic of Congo discussed cooperation with Angola in the petroleum sector, and an agreement was signed in 1979. A special agreement pertaining to sending Cape Verdian workers to Angola was signed in May 1979 during the second session of the Joint Angola-Cape Verde Committee for Economic, Scientific and Technical Cooperation.

Following meetings in Lusaka, Zambia, in early 1979, it was agreed between Zambia, Zaire, and Angola that an effort must be made to reopen and improve the Benguela railroad. Refurbishing the railway was expected to be expensive, requiring about $106 million. The many technical problems included deterioration of the signaling system and maintenance and repair of rolling stock, which had not been used for more than 4 years. Angola was seeking $80 million for her share of a three- phase development plan for the railway. The phase in Angola was to include bridge reconstruction and purchase of 17 mainline locomotives, 10 shunting engines, 900 freight cars, and 26 passenger coaches. About $27 million was promised from several sources for the first phase as a result of talks held in Belgium in June 1979. Of the total, $10.4 million each was to be provided by the European Economic Community (EEC) and the Arab Development Bank, and the rest was to be split between 10 Western nations. Later in the year, promises by Sweden and the Organization of Petroleum Exporting Countries (OPEC) raised the contributions to $35.8 million. Financing for the second stage, costing about $57 million, was to be considered in 1980. Stockholders in the railroad included Angola Government (10%), Chrewe Holdings Ltd. (9%), Darjeeling Developments Ltd. (9%), Everton Enterprises Ltd. (9%), Farnington Trading Ltd. (9%), Rocket Overseas Investment Ltd. (9%), Ticlio Investments Ltd. (9%), Yoxal Investment Ltd. (9%), and the operator, Tanganyika Concessions Ltd. (8.8%).[7]

Although the Benguela railway was operating wiithin Angola during 1978, functioning of the line for international traffic never progressed beyond the formal opening ceremony in November 1978. Dissidents fighting against the present Government interfered until April 1979, when the first train to carry Zairian manganese ore from Sisenge arrived safely in Lobito. Through most of 1979 the line was far from secure. The six to eight major bridges along the railroad were being heavily guarded to ward off attacks.

Other transportation improvements included a new road between Angola and Zambia. Costing about $80 million, the road would provide a short cut from Zambia to Angola's Benguela railroad and port of Lobito. Work began on the road in 1979. Angola's maritime ports were also being renovated. Fourteen cranes were ordered from the German Democratic Republic to equip ports in Luanda, Lobito, and Mocamedes. Experts from the East German company Eberswalds were to train Angolans to operate and repair the cranes. Work on the new port of Cabinda also began in 1979 and was scheduled to last 2 years. Hidroportes, a national firm, was to be in charge of the construction. The port will have three mooring wharves.

PRODUCTION AND TRADE

Petroleum production increased during 1978 and 1979 as Government policies became more oriented towards mineral development. With renewed prospecting and opening of new wells, petroleum production was expected to double by 1985. Petroleum prices were also escalating as the Angolan Ministry of Petroleum increased the price from $21.04 to $23.23 (fob) per barrel on July 1, 1979. Payment terms were also shortened from 60 to 45 days. By January 1, 1980, the price per barrel of contract oil was $31.70. Diamond production also improved, and by 1979 had nearly doubled as corrective measures were taken to improve the mining environment. Iron ore mining was still not resumed since the mine closure of August 1975. The Empresa Nacional do Cimento do Lobito exported about 9,000 tons of cement to Nigeria in early 1979. This company reportedly produced more than 100,000 tons of cement in 1978.

Total exports were valued at $1 billion in 1978; oil formed 72% and diamond 7.7% of the total. New trade pacts included one between Brazil and Angola signed in 1979 that would insure Brazil of receiving between 15,000 and 20,000 barrels of Angolan oil per day, beginning in early 1980. In return, Brazil will furnish various manufactured goods and equipment such as gasoline storage tanks and other accessories for fuel distribution. Zambia will start buying Angolan oil and cement in 1981 in return for copper and zinc product sold to Angola as a result of recent trade discussions. A trade agreement was also signed with Portugal in early 1979 that was the first practical result of the general cooperation treaty signed in June 1978, which was to deal in the future with economic and financial differences between the two nations. Trade between Angola and Portugal had decreased since the high point of 1974, when Portugal consumed 27% of Angola's exports, to a low point in 1976, when Portugal received only 6% of Angola's exports . U.S. trade with Angola was valued at $202 million for the first 11 months of 1978; this compares with $312 million for the same

Table 1.-Angola: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Gold, mine output, metal content[e] troy ounces	([2])	([2])	--	--
Iron and steel: Crude steel	5,000	5,000	10,000	10,000
NONMETALS				
Cement, hydraulic thousand tons	[r]300	300	400	400
Clays: Kaolin	--	500	--	NA
Diamond:				
Gem thousand carats	255	265	525	562
Industrial do	85	88	175	188
Total do	340	353	700	750
Gypsum	20,000	20,000	25,000	25,000
Salt	[r]50,000	50,000	50,000	50,000
Talc[e]	50	--	--	--
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural[e]	20,000	[r]25,000	25,000	25,000
Gas, natural:[e]				
Gross million cubic feet	22,000	42,400	46,500	46,500
Marketable do	2,000	2,500	2,500	2,500
Petroleum:				
Crude thousand 42-gallon barrels	36,700	62,437	47,450	60,000
Refinery products:				
Gasoline do	429	526	510	500
Jet fuel do	446	441	480	450
Kerosine do	136	163	160	160
Distillate fuel oil do	949	1,469	1,567	1,500
Residual fuel oil do	2,924	3,725	3,796	3,700
Other do	120	143	189	150
Refinery fuel and losses do	184	229	368	300
Total do	5,188	6,696	7,070	6,760

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and broken stone) presumably is produced for local consumption, but information is inadequate to make reliable estimates of output levels.

[2] Revised to none.

1977 period and $264 million for the first 11 months of 1976.[10] A law was passed in 1978 establishing a state enterprise, Angolan Exportation Company (EXPORTANGUEE), which was to have the objective "of exporting products and carrying on business operations" for the Ministry of Foreign Trade.

The fourth meeting of the intergovernmental group for establishing a preferential trade zone in eastern and southern Africa was held in June 1979 in Luanda, Angola, with delegations from 16 nations participating. The conference was held under the auspices of the Economic Commission for Africa (ECA), a United Nations agency, and was attended by Angola, Botswana, Comoro Islands, Djibouti, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Seychelles, Somalia, Swaziland, Uganda, Tanzania and Zambia. According to ECA, this was a first step toward forming a subregional common market.

COMMODITY REVIEW

METALS

Cobalt.—The extended copperbelt (from Zambia) in Angola has seen extensive exploration for cobalt. Geological reports apparently have indicated significant mineralization, but concern about political stability in eastern Angola has prevented further studies and development.[11]

Iron Ore.—New reports indicated a contract had been signed in 1979 with Austromineral, a subsidiary of the Austrian company Voest-Alpine AG, to study the possibility of renewing mining at the Cassinga iron ore mine. Austromineral was also to draw up plans for a new iron ore mine in the vicinity of Cassala-Quitungo, which will be slated to produce approximately 2 million tons of iron ore pellets per year.[12]

NONMETALS

Building Stone.—A shipment of 500 tons of black granite was exported from the port of Mocamedes to Japan in the middle of July 1978. This was the first commercial shipment of this stone since 1975.[13]

Cement.—A decree published in September 1978 allowed for the nationalization of part of the Secil Ultramar Cement Company. Shares excepted from this move were held by the Cement Investment Inc., FLS Overseas Inc., F.L. Smidth and Co., Inc., Potagua Inc., Knud Hojaards Fond, Contractor Holdingselskab, Ejendomsaktieselskbet Biblioteksgaarden, and several private Danish individuals. Only the Portuguese participation in the company was nationalized, including 29% held by the Lisbon company Secil and another 10% held by private Portuguese shareholders.[14]

Diamond.—In 1978, the Portuguese Government, on behalf of the nationalized Companhia de Diamantes de Angola (DIAMANG) Portuguese shareholders, froze about $8 million in DIAMANG assets in an attempt to force the Angola Government to negotiate more favorable conditions for operating the diamond marketing and for payment of $90 billion claimed for the nationalized assets. Portugal was demanding to continue as middle man between Angola and the Central Selling Organization because it felt that diamond sorting could not be properly carried out in Luanda. They also asked that Angola sign a 30-year operating contract with DIAMANG, that it have the status of a foreign-operated firm, and that remuneration be paid to the operator as 40% of the firm's net profit. The Angolan Government felt that 85% of DIAMANG'S former assets were already amortized and that the sum demanded by the Portuguese was inflated. Angola claimed to have also financed $33 billion in 1976 and 1977 to enable DIAMANG to meet its local wage and supplier obligations.[15] Consequently, after a special stockholders meeting in late 1977, in which a new board of directors dominated by Angolans was elected, the Angolans took charge of management and conduct of all DIAMANG's operations. In an effort to increase production, wages were increased for local miners and the company began to recruit managerial expertise from outside the country. Mining experts and technicians were being actively recruited from Europe through the Technical Services (MATS) Company in the United Kingdom, and a Belgian firm was cooperating in financial operations. To help stop illicit trading, a law was passed making it an offense to buy, sell, or give away a diamond, whether it was cut or not. On December 11, 1979, a further 283,039 shares of DIAMANG stock belonging to Portuguese entities were nationalized, and the

Angolan Government's share in the company was increased to 77.21%.

Quartz.—Quartz crystal and fusing quartz was being mined 50 kilometers south of Gabela in the west central part of Angola. Production at this new (1975) mine ceased during the civil war and was revived in 1977. The Government nationalized the operating company, Icomi Angola Ltd., in June 1978. Output for 1978 was about 1,500 tons, of which 25 tons was Grade A crystal quartz, with the remainder Grade B fusing quartz. Both grades of quartz contain 99.9% silicon dioxide with trace amounts of alumina, calcium, iron, potassium, sodium, titanium, and lithium. A third quality, Grade C, has a similar composition to Grade B, but is milky rather than transparent. Shipments are made through Porto Amboim. O. Priess & Co. a West German-based trading company, was awarded the quartz.

MINERAL FUELS

Petroleum and Natural Gas.—At yearend 1978, Angola had proven petroleum reserves of 1.4 billion barrels, down 3% from the 1977 reserve estimate; natural gas reserves were estimated at 47 billion cubic meters.[16] Angola's crude production of about 130,000 barrels per day came from a total of 171 producing wells at yearend 1978. Six wells out of a total of 14 new wells drilled in 1978 encountered oil. Plans for gas reinjection to improve production were to be implemented by Gulf Oil Company in 1981. A new agreement was signed with Texaco Petroleos da Angola in 1979 to develop three additional oilfields, which will add a further 50,000 barrels per day. The cost of developing these three fields (Essungo, Etele, and Cuntala) was estimated at $250 million.

According to the Petrofina annual report for the financial year 1978, the company's share of crude production from fields in the Kwanza and Congo basins was 7.7 million barrels, a reduction of about 12% compared with the previous year. This reduction, which was appreciable in the first half of the year, was due to the application of a Government ruling. Petrofina also reported the discovery of a small oilfield in the Congo basin in the Cuntala structure. Besides being a majority holder in Petrangol, Petrofina also owned 56.98% of Fina Angola, a petroleum distribution company. Fina was nationalized and integrated into Sonangol by the Government on January 1, 1979.[17]

Angola hired the U.S.- based consulting firm Arthur D. Little to advise it on oil legislation. A new loan law providing for state ownership of all newly found oil deposits was promulgated, with an offering of production sharing to be made between the national oil company,Société Nationale des Combustibles (Sonangol), and the firm making the discovery. Under terms of a new contract, Gulf Oil Company will retain an undivided 49% interest in petroleum production, while title to the Cabinda offshore concession belongs to Sonangol. Gulf's production of about 80,000 barrels per day was still far below the 130,000 barrels per day that the company could produce before the 1975 revolution that effectively halted development and exploration drilling for a short period. The State took a 16% royalty and an income tax of 65.75%, based on realized prices for Gulf's 49% share of production.

Sonangol was negotiating with a number of major oil companies over exploration concessions, offering a production-sharing plan for successful finds. Part of the 1979 agreement signed with Texaco included expenditure of about $110 million on exploration Block 2 and covered an area of 4,000 square kilometers of the Congo River Basin. Texaco will act as operator and will take a 40% share in the partnership with Sonangol, which will reserve the right to assign part of its 60% share to other companies. Both parties will contribute their proportionate share of costs and will share the venture's "profit oil." The profit oil will be divided between Sonangol and the partnership on a sliding scale, with 70% to 95% accruing to the state and the balance to the partnership. Sonangol's share of profit oil could be a minimum of 88% and a maximum of 98%, if it retains a full 60% participation. The venture will be taxed at 50% of the value of profit oil, through an arrangement which is intended to avoid double taxation of Texaco's earnings.[18]

The French oil company Elf-Aquitaine was granted offshore exploration rights in an agreement that would involve $41 million invested over a 3-year period. The concession covered an area of 4,000 square kilometers known as Block 3 in the Soyo area. Elf will be the operating company and hold a 50% interest. The group will include other foreign companies, which had not been named. Sonangol will retain 15% of the oil production initially, rising to 95% later.[19]

A production-sharing agreement was also signed by Total Compagnie Africaine des Petroles (Total-CAP) and Sonangol to invest

$30 million over 5 years in offshore oil prospecting. Total-CAP will be operator in a 4,000-square-kilometer tract offshore of Luanda. An agreement signed with Brazil's state-run oil company Petrobras in early May 1979 was to increase Brazilian-Angolan cooperation in several areas. Angola was to purchase oil rigs, drills, and other materials from Brazil, and Petrobras' international branch, Braspetro, was also to train Angolans in various aspects of oil production. The arrangement also included the provision of petroleum to Brazil.

Under a cooperation agreement signed with the Soviet Union, Sonangol will receive aid in offshore drilling operations and assistance with construction of a refined petroleum product storage facility. The Soviet Union will also train Angolan technicians. Sonangol also signed a cooperation agreement with Petrogal, the Portuguese nationalized oil company, for an interchange of technical expertise and future contracts for processing for crude oil at Portugal's main refineries at Sines, south of Lisbon.

Angola reported domestic petroleum products consumption of 2 million barrels for 1976, 2.6 million barrels for 1977, and 3 million barrels for 1978. A 90% increase in domestic consumption of petroleum products was anticipated for 1979.[20] Efforts to improve petroleum product supply service between Luanda and Cabinda included the acquisition in 1979 of a new petroleum tanker, Ngoleo, from Portugal. The new tanker allowed for more economical connections between the Luanda refinery and Cabinda Province. New bulk fuel storage facilities were also commissioned in Cabinda, and a provincial agency for marketing fuel products through Sonangol was established to improve distribution of petroleum products in Cabinda. The tanker had a liquid capacity of 300 cubic meters and could carry about 4 tons of miscellaneous cargo on deck.

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[1] Physical scientist, Branch of Foreign Data.

[2] Barclays Bank Group Economics Dept. ABECOR Country Report. December 1979, 2 pp.

[3] Angola's domestic currency is the kwanza. 1 kwanza = 100 lwei. No currrent foreign exchange statistics are available. The kwanza replaced the Angolan escudo.

[4] Africa Report. Southern Africa, Angola. V. 24, No. 5, September-October 1979, p.37.

[5] Jornal de Angola (Luanda). Law on State Ownership of Mineral Resources Promulgated. May 11, 1979, pp 1, 6.

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[16] World Oil. World Trends. Aug. 15, 1979, p. 64.

[17] Jornal de Angola (Luanda). Sonangol, New Tanker, Foreign Oil Companies Activities Reviewed. May 23, 1979, pp. 3, 6.

[18] Petroleum Economist (London). Angola. 1979, V .46, No. 10, October, p. 433.

[19] West Africa (London). Details on French Oil Deal. Nov. 5, 1979, p. 2056.

[20] Work cited in footnote 17.

The Mineral Industry of Argentina

By Orlando Martino[1]

Argentina's gross domestic product (GDP) declined by 4% in real terms in 1978 and was valued at $61 billion[2] at current prices. The economic recession resulting from the Government's stabilization program did not reduce inflation. The rate of inflation in 1978 increased slightly to 170% and ranked among the highest in the world, but was estimated to moderate to about 110% in 1979. The economy rebounded in 1979 and preliminary data indicate growth of the GDP in real terms of 7.5%.

Although Argentina has high mineral potential, its mineral industry, not including mineral fuels—coal, petroleum, and natural gas—accounted for less than 1% of GDP. More than two-thirds of Argentina's limited mining output was related to nonmetallics and industrial minerals, including products for the construction industry. The economic recession in 1978 was reflected primarily in the manufacturing sector where production decreased 7% and resulted in a drop in the domestic demand for metallic minerals. Production drops of 24% and 78% in the automotive and tractor industries, respectively, enabled Argentina to increase exports of steel. The construction industry, on the other hand, increased 8% in activity and helped form the basis for Argentina's record output of cement.

Argentina continued as the third largest producer of crude petroleum in Latin America, after Venezuela and Mexico, with new discoveries providing the basis for increased estimates of petroleum reserves. Increased petroleum output, a historic high in 1978, enabled Argentina to improve its self-sufficiency status to 93%, among the highest of the industrialized countries. Argentina was also a leading producer of natural gas in Latin America with a self-sufficiency status of 79% and ranked third in the region in proved reserves. Yacimientos Petrolíferos Fiscales (YPF) and Gas del Estado, both State-owned, were actively engaged in investment programs with the purpose of gaining national self-sufficiency in crude oil and natural gas.

In addition to this reduction in dependency on foreign crude oil, another salient event in 1978 was Argentina's achievement of self-sufficiency in aluminum from the aluminum smelter at Puerto Madryn that started up in 1976. Output at full capacity expected in 1979 would enable Argentina to become an exporter of this metal for the first time.

In 1978, the Government announced a $20.5 billion national investment plan for the 1979-81 period that would place a positive demand on the mineral industry of Argentina. About half of the new foreign investment in 1978 related to imports of capital goods for petroleum and natural gas production, and were almost entirely of U.S. origin.

Concerning new legislation, the long-awaited Risk Contract Hydrocarbon Law No. 21,778 was made public in April 1978 by the Secretary of Energy. It was designed to encourage exploration and development by local and foreign companies. Implementing regulations, Decree 1885 of August 15, 1978, were issued regarding the Transfer of Technology Law promulgated in August 1977. The long-awaited Mining Promotion Law No. 22,095 that replaces Law 20,551 was approved by the Government in late 1979 and became effective November 7 of said year. Reforms to Argentina's Mining Code were expected in early 1980.

In December 1979 the Secretary of Mining made four loans involving private exploration projects for copper, lead, silver, gold, bentonite, and fluorite in the Provinces of Chubut, Mendoza, Salta, and San Juan.

Argentina was determined to use its sizable natural gas reserves to replace as much petroleum as possible. In 1978, Buenos Aires was ordered to convert heating systems to natural gas within 6 years. The Government gas company, Gas del Estado, was expected to begin construction of a $75 million expansion of its gas system in Buenos Aires with 225 kilometers of new pipelines.

The Government was embarked on a program of reducing its use of oil and gas for electrical energy generation, while increasing the use of hydroelectric and nuclear resources. The Government was planning to substitute oil for natural gas where possible to take advantage of the large gas reserves of Tierra del Fuego. In 1978, hydroelectric sources met 26% of total electrical energy demand, and nuclear power, 10%. Argentina's total installed electrical generating capacity increased 12.7% to 11,456 megawatts. The energy development plan for 1977-78 of $24.4 billion prepared by the Secretariat of Energy includes $12 billion for electrical energy development.

In 1978 the Inter-American Development Bank (IDB) approved a $210 million loan to Entidad Binacional Yacyretá (EBY), an institution created by a treaty between Argentina and Paraguay to help build the 2,700-megawatt multipurpose Yacyretá-Apipé hydroelectric complex on the Río Paraná. The cost of the complex on the border of the countries was estimated to exceed $4.5 billion. The complex is scheduled for completion in 1985.

By yearend the civil works were practically completed for the 1,890-megawatt Salto Grande hydroelectric complex on the Río Uruguay being executed by the Comisión Mixta de Salto Grande established by Argentina and Uruguay. Several of the 14 large turbines had arrived at the dam site for installation. In 1978 the 440-megawatt hydroelectric station of Futaleufú in Chubut Province was completed.

PRODUCTION

Data on Argentina's production of minerals and mineral fuels for 1978 and 1979 are given in table 1. The mineral industry of Argentina continued to be geared to the demands of the domestic market. The low production of strategic mineral commodities such as ores of copper and iron made it necessary to rely heavily on foreign supply. There was no output of bauxite to supply the expanding aluminum industry.

Aside from the mineral fuels such as coal, natural gas, and petroleum, mining output continued to be dominated by the nonmetallics and industrial minerals. In 1977, for example, mine production of metallic ores and concentrates represented only 15% of the total value of mining production. In contrast, mine production of metals in Brazil account for 30% of total value.

A salient event of 1978 was Argentina's achievement of self-sufficiency in aluminum production. Aluminum output reached a record high from increased utilization of capacity as more power became available from the Futaleufú dam. Output of primary iron, crude steel, and cement also reached historic high levels. Production of crude petroleum continued to rebound from the depressed level of 1975 and exceeded the peak output of 1972 up to record highs in 1978 and 1979. On the other hand, production of lead/zinc concentrate and natural gas in 1978 was lower than in 1977.

Table 1.—Argentina: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum metal:				
Primary	43,122	49,875	53,098	90,000
Secondary	9,500	6,500	8,000	9,000
Antimony, mine output, metal content kilograms	2,200	--	--	--
Beryllium: Beryl concentrate:				
Gross weight	112	170	199	180
BeO content	13	18	22	20
Bismuth kilograms	--	--	300	300
Columbium-tantalum concentrates, gross weight:				
Columbite do	107	614	300	350
Tantalite do	175	170	150	150

See footnotes at end of table.

Table 1.—Argentina: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978^{p}	1979^{e}
METALS —Continued				
Copper:				
Mine output, metal content	265	169	220	200
Smelter^{e}	60	70	70	70
Gold, mine output, metal content ... troy ounces	5,804	5,509	5,514	5,500
Iron and steel:				
Iron ore and concentrate, gross weight ... thousand tons	506	1,030	1,001	1,220
Pig iron ... do	1,306	1,380	1,819	^{2}1,942
Ferroalloys, electric furnace:				
Ferromanganese	23,841	28,780	25,115	31,000
Silicomanganese	6,300	6,168	10,281	12,000
Ferrosilicon	17,052	15,313	10,343	17,000
Other	533	823	448	1,000
Total	47,726	51,084	46,187	61,000
Crude steel ... thousand tons	2,422	2,676	2,780	^{2}3,240
Semimanufactures[3] ... do	2,004	2,356	2,205	2,300
Lead:				
Mine output, metal content	33,004	33,305	29,801	31,000
Smelter:				
Primary	50,000	45,000	31,300	35,000
Secondary	6,000	6,000	6,000	6,000
Total	56,000	51,000	37,300	41,000
Manganese ore and concentrate, gross weight	53,086	82,385	91,152	90,720
Silver, mine output, metal content ... thousand troy ounces	2,250	2,451	^{e}2,600	2,600
Tin:				
Mine output, metal content	358	537	513	500
Smelter^{e}	120	120	120	120
Tungsten, mine output, metal content	62	70	79	78
Uranium, mine output, U_3O_8 content ... kilograms	205,437	217,898	183,456	190,000
Zinc:				
Mine output, metal content	40,589	39,155	36,943	38,000
Smelter, primary	35,200	29,000	23,900	37,000
NONMETALS				
Asbestos	889	686	697	700
Barite	40,546	30,571	33,061	36,000
Boron materials, crude	80,851	83,051	68,054	64,000
Cement, hydraulic ... thousand tons	5,712	5,829	6,153	6,350
Clays:				
Ball clay	1,465	1,812	2,110	NA
Bentonite	132,313	114,836	119,201	145,000
Foundry earth	211	201	NA	NA
Fuller's earth (decolorizing clay)	3,133	4,129	3,479	4,000
Kaolin	83,726	74,284	75,640	80,000
Laterite (aluminous)	33,324	59,363	NA	NA
Refractory	119,233	117,299	118,265	120,000
Other[4]	557,879	565,066	NA	NA
Diatomite	13,850	12,337	10,821	10,300
Feldspar	68,224	42,921	46,298	47,000
Fluorspar	40,077	43,792	41,000	42,200
Graphite	145	85	25	91
Gypsum, crude	507,125	546,928	552,668	562,500
Lithium, spodumene, and amblygonite, gross weight	675	412	950	900
Mica:				
Sheet	329	302	311	295
Waste and scrap	2,291	1,840	1,985	1,996
Nitrogen: N content of ammonia	37,600	42,000	47,200	45,000
Phosphate:				
Guano^{e}	1,000	1,000	1,000	1,000
Thomas slag	1,693	NA	NA	NA
Pigments, mineral, natural: Ocher	174	209	221	200
Precious and semiprecious stones: Amethyst ... kilograms	500	--	--	NA
Pumice and related volcanic materials	57,593	64,961	70,160	72,000
Rhodochrosite	11	47	42	NA
Salt:				
Rock ... thousand tons	1	1	1	1
Solar ... do	660	1,146	960	998
Total ... do	661	1,147	961	999
Sand and gravel:				
Sand:				
Construction ... do	14,893	16,178	16,901	NA
Ferruginous-titaniferous ... do	280	1,833	NA	NA
Silica sand (glass sand) ... do	269	284	292	295
Gravel ... do	5,990	9,214	11,632	12,000

See footnotes at end of table.

Table 1.—Argentina: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978^{p}	1979^{e}
NONMETALS —Continued				
Stone:				
Basalt ... thousand tons	2,517	3,075	3,187	NA
Calcareous:				
Calcite, nonoptical	12,418	11,153	11,450	NA
Calcium carbonate[5]	58,109	52,997	53,300	NA
Dolomite	245,261	225,792	229,279	NA
Limestone ... thousand tons	13,608	14,081	14,486	NA
Marble:				
Aragonite, broken	6,408	7,701	8,160	NA
Onyx, in blocks and broken	31,009	24,364	25,443	NA
Travertine, in blocks and broken	13,308	9,367	9,203	NA
Unspecified, in blocks and broken	69,209	61,166	NA	NA
Shell marl	605,193	428,908	435,004	NA
Flagstone	84,472	73,505	74,890	NA
Granite:				
Blocks	24,699	25,944	27,498	NA
Other dimension	8,250	--	--	NA
Crushed ... thousand tons	4,343	4,932	5,129	NA
Quartz, crushed ... do	116,410	103,438	110,300	NA
Quartzite, crushed ... do	1,269	1,327	1,456	NA
Sandstone	47,994	129	140	NA
Serpentine, crushed	55,748	27,449	29,590	NA
Tuff, tufa ... thousand tons	2,006	1,971	2,014	NA
Strontium mineral: Celestite	2,054	839	900	900
Sulfates, natural:				
Aluminum (alum)	24,800	29,421	35,000	37,000
Iron (melanterite)	--	10	NA	NA
Magnesium (epsomite)	12,412	5,487	5,800	6,000
Sodium (mirabilite)	35,489	36,022	37,000	44,000
Sulfur:				
Native, from caliche	20,000	27,000	34,000	35,000
Byproduct, all sources	19,000	20,000	20,000	20,000
Total	39,000	47,000	54,000	55,000
Talc and related materials:				
Pyrophyllite	9,132	10,947	4,631	8,000
Steatite	840	454	500	500
Talc	44,185	43,306	43,000	45,900
Total	54,157	55,110	48,131	54,400
Vermiculite	4,098	4,825	5,343	5,400
Zeolite	23	15	12	15
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	818	6,339	4,553	5,000
Carbon black^{e}	30,000	30,000	NA	NA
Coal, bituminous ... thousand tons	615	533	434	[2]732
Coke, all types, including breeze ... do	738	727	686	650
Gas, natural:				
Gross ... million cubic feet	^{r}389,584	411,867	406,265	443,600
Marketed ... do	^{r}272,284	274,992	259,678	[2]283,560
Natural gas liquids:				
Natural gasoline ... thousand 42-gallon barrels	447	NA	NA	NA
Butane ... do	1,784	1,209	1,630	1,500
Propane ... do	1,485	985	1,260	1,200
Total ... do	^{r}3,716	2,194	2,890	2,700
Peat, agricultural	9,532	6,207	3,800	4,000
Petroleum:				
Crude ... thousand 42-gallon barrels	145,561	157,248	165,138	[2]172,759
Refinery products:				
Gasoline ... do	34,071	35,916	38,489	[2]40,538
Jet fuel ... do	3,784	4,054	4,503	[2]4,809
Kerosine ... do	6,178	5,872	5,090	[2]4,190
Distillate fuel oil ... do	42,849	46,189	46,961	[2]49,124
Residual fuel oil ... do	53,199	58,234	55,861	[2]58,381
Lubricants ... do	1,615	1,986	1,698	[2]2,106

See footnotes at end of table.

Table 1.—Argentina: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]		1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Other	thousand 42-gallon barrels	10,080	16,789	8,482	8,500
Refinery fuel and losses	do	13,882	7,808	16,218	14,591
Total		165,658	176,848	177,302	[2]182,239

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities listed, cadmium, lime, and perlite are also produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

[3] Hot-rolled semimanufactures only; excludes castings and cold-rolled semimanufactures produced from imported hot-rolled semimanufactures.

[4] Includes plastic, semiplastic, and/or ferruginous clays used totally in the manufacture of portland cement.

[5] As reported; differentiation between this material and other calcareous stones reported is not apparent from the source publication.

TRADE

Argentina's favorable balance of trade showed further improvement in 1978 as the trade surplus widened to $2.40 billion compared with the $1.49 billion surplus of 1977. Total exports valued at $6.35 billion increased 12% while total imports of $3.94 billion decreased 5% in line with the generally depressed state of the economy. Mineral commodities were a very small part of Argentina's exports dominated by agricultural commodities such as grains, meat products, hides, and wool.

According to statistics published by the Secretaria de Estado de Mineria, exports of minerals, partially refined products and metals, not including steel or mineral fuels, reached an all time high of $34 million in 1978, a 64% increase over the $21 million exported in 1977 and almost triple the $12 million exported in 1975. Although mineral exports are insignificant in total trade, they indicate an increasing trend in the export of Argentina minerals. Diverse mineral products were exported to 30 countries, and 153 local companies were involved in international sales. The more important mineral exports ranked by value and their major markets are shown below for 1978:

Mineral exports	Value in thousand dollars	Major markets
Sodium borate	6,530	Brazil, United States.
Lead concentrate	6,093	Brazil, United States, Belgium.
Tin/silver concentrate	5,274	Great Britain.
Zinc ingot	3,770	Brazil, Uruguay, Holland.
Borate compounds	2,125	Brazil, Uruguay.
Granite blocks	1,175	Italy, Spain.
Salt	1,003	Paraguay, Nigeria.
Uranium concentrate	929	Great Britain.
Boric acid	847	Brazil, United States.
Perlite, expanded	693	Brazil, Chile.
Bentonite	623	Brazil, Chile, Bolivia.
Lead ingot	598	Uruguay, Japan.

Brazil (55%) was the major export market in 1978, followed by Great Britain (19%), the United States (5%), Italy (4%), Paraguay (4%), and Uruguay (3%). The countries of the Latin American Free Trade Association (LAFTA) purchased 63% of Argentina's mineral exports, and the European Economic Community, 22%. As for particular commodities, increased amounts of boric acid, clays, processed borates, sodium borates, zinc ingot, and dolomite were exported during 1978.

After a lapse of 10 years, Argentina in mid-1979 resumed mineral exports to the Soviet Union with a shipment of zinc concentrate from the El Aguilar mine valued at $1.8 million.

Argentina's exports of steel increased substantially in 1978 by $250 million, while imports decreased. For example, imports of pig iron decreased from 136,000 tons in 1977 to 50,000 tons in 1978 and semimanufactures decreased sharply from 851,000 in 1971 to 350,000 tons in 1978.

After a lapse of decades in 1979 Argentina resumed exports of gold and silver valued at $5 million. They were produced by Cerro Castillo S.A. operating mines in Chubut Province.

Imports of primary materials, semimanufactures, and fuel and lubricants represented 68% of Argentina's total imports in 1978. Imports of petroleum, valued at $218 million, decreased 3% relative to 1977 while imports of natural gas from Bolivia and Chile, valued at $108 million increased 15% to cover the decline in domestic output. The drastic reduction in aluminum imports from almost 73,000 tons in 1972 to zero in 1978 and 1979 reflected Argentina's success in achieving self-sufficiency in this important metal. Calcined alumina was imported mostly from Australia.

Imports from the United States in 1978 were 22% of Argentina's total, up from 18.5% in 1977, of which the most important mineral-related commodity continued to be metallurgical coal. The United States was Argentina's largest single trading partner overall.

Table 2.—Argentina: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum:		
Oxide (alumina) and hydroxide	14	(1)
Metal including alloys, all forms	514	867
Beryllium: Beryl ore and concentrate	--	163
Chromium oxide and hydroxide	1	(1)
Copper metal including alloys, all forms	190	222

See footnotes at end of table.

Table 2.—Argentina: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS —Continued		
Iron and steel:		
Pig iron and similar materials	32	(1)
Ferroalloys	70	2,051
Steel, primary forms	265	1
Semimanufactures:		
Bars, rods, angles, shapes, sections	212,488	86,044
Universals, plates, sheets	104,078	114,093
Hoop and strip	501	901
Rails and accessories	932	4
Wire	865	1,338
Tubes, pipes, fittings	22,528	58,137
Castings and forgings, rough	442	410
Lead:		
Oxide	496	65
Metal including alloys, all forms	1,323	32
Silver metal thousand troy ounces	--	(1)
Tin metal including alloys, all forms	50	5
Zinc:		
Oxides	(1)	(1)
Metal including alloys, all forms	1,217	277
Other:		
Ash and residue containing nonferrous metals	25	125
Oxides, hydroxides, peroxides of metals	(1)	1
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	(1)	(1)
Grinding and polishing wheels and stones	31	69
Asbestos	(1)	1
Barite	2	--
Boron materials:		
Crude natural borates	9,447	11,099
Oxide and acid	1,197	244
Borates and perborates	12,504	6,808
Cement	7,489	5,449
Chalk	727	388
Clays and clay products (including all refractory brick):		
Crude:		
Bentonite	7,494	9,984
Kaolin	20	103
Other	122	9,984
Products:		
Refractory (including nonclay bricks and cement)	564	469
Nonrefractory	656	944
Diatomite and other infusorial earth	10	16
Fertilizer materials:		
Manufactured:		
Nitrogenous	22	--
Phosphatic, Thomas slag	16	--
Mixed	--	4
Ammonia	165	153
Fluorspar	5,739	240
Gypsum and plasters	16,727	21,751
Lime	88	2,115
Lithium and lithium compounds	50	220
Mica:		
Crude, including splittings and waste	1,367	3,884
Worked, including agglomerated splittings	(1)	(1)
Pigments, mineral:		
Natural, crude	--	3
Iron oxides, processed	124	174
Precious and semiprecious stones, except diamond, natural kilograms	8	(1)
Salt	24,201	25,395
Sodium and potassium compounds, n.e.s	5	2
Stone, sand and gravel:		
Dimension stone:		
Crude	14,303	14,336
Worked	1,902	1,431
Dolomite	1,040	3,112
Gravel and crushed rock	9,333	119
Quartz	47	25
Sand	15	33
Ornamental:		
Onyx	30	30
Rhodochrosite	(1)	3

See footnotes at end of table.

Table 2.—Argentina: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
NONMETALS —Continued		
Sulfur:		
Sulfur dioxide	[1]	1
Sulfuric acid	52	107
Talc, steatite, soapstone, pyrophyllite	183	362
Other:		
Crude	210	220
Slag, dross, and similar waste, not metal bearing	1,224	1,802
Bromine, fluorine, iodine	1	2
Oxides, hydroxides, and peroxides of strontium, barium, magnesium	8	4
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	349	242
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	198	152
Carbon black	3,029	3,865
Coal, all grades	507	638
Coke and semicoke	10,033	56,336
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	445	146
Distillate fuel oil do	98	212
Residual fuel oil do	312	1,254
Lubricants do	21	5,152
Other:		
Liquefied petroleum gas do	102	106
Mineral jelly and wax do	32	34
Bitumen and other residues do	36	48
Bituminous mixtures, n.e.s do	16	31
Petroleum coke do	910	1,560
Unspecified do	[1]	24
Total do	1,977	8,567
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	[1]	315

[1] Less than 1/2 unit.

Table 3.—Argentina: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum:		
Bauxite and concentrate	20,691	20,456
Oxide (alumina) and hydroxide	50,572	150,431
Metal including alloys, all forms	21,811	393
Antimony:		
Ore and concentrate	533	368
Metal including alloys, all forms	[1]	[1]
Arsenic:		
Trioxide and acids	396	322
Metal including alloys, all forms	22	1
Bismuth metal including alloys, all forms	20	13
Cadmium metal including alloys, all forms	[1]	21
Chromium:		
Chromite	4,111	4,562
Oxide and hydroxide	1	3
Metal including alloys, all forms	3	38
Cobalt:		
Oxide and hydroxide	[r]19	10
Metal including alloys, all forms	84	78
Columbium and tantalum: Tantalum metal including alloys kilograms	89	99
Copper:		
Ore and concentrate	1,020	2,151
Metal including alloys, all forms	29,391	37,161
Gold metal, unworked or partly worked troy ounces	7,234	6,237
Iron and steel:		
Ore and concentrate thousand tons	1,745	2,377

See footnotes at end of table.

Table 3.—Argentina: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS —Continued		
Iron and steel —Continued		
Metal:		
Scrap thousand tons	72	160
Pig iron, including spiegeleisen do	72	136
Sponge iron, powder, shot	1,955	1,676
Ferroalloys	7,123	7,133
Ingots and other primary forms thousand tons	791	851
Semimanufactures:		
Common steel:		
Bars and rods do	3	5
Angles, shapes, sections do	15	18
Universals, plates, sheets do	180	108
Hoop and strip do	3	3
Rails and accessories	924	3,502
Wires	292	785
Tubes, pipes, fittings thousand tons	14	24
Castings and forgings	65	97
High-carbon and alloy steel, all forms thousand tons	28	32
Lead:		
Ore and concentrate	5,471	1,666
Oxides	23	15
Metal including alloys, all forms	303	71
Magnesium metal including alloys, all forms	416	682
Manganese:		
Ore and concentrate	67,263	121,416
Oxides	1,305	1,228
Metal	60	219
Mercury 76-pound flasks	2,401	1,961
Molybdenum:		
Ore and concentrate	19	19
Metal including alloys, all forms	9	13
Nickel metal including alloys, all forms	581	984
Platinum-group and silver metals:		
Platinum-group troy ounces	1,840	4,200
Silver thousand troy ounces	382	1,025
Rare-earth metals and compounds	62	56
Selenium, elemental	9	10
Tellurium kilograms	53	54
Tin metal including alloys, all forms	987	630
Titanium:		
Ore and concentrate	1,809	2,053
Oxides	806	720
Metal including alloys, all forms	43	46
Tungsten metal including alloys, all forms	7	117
Zinc:		
Ore and concentrate	3,254	1,168
Oxides	203	143
Metal including alloys, all forms	3,259	2,379
Zirconium ore and concentrate	10	92
Other:		
Ores and concentrates	739	1,204
Oxides, hydroxides, peroxides of metals, n.e.s	544	1,015
Metals including alloys, all forms:		
Metalloids	3,940	3,031
Pyrophoric alloys kilograms	214	855
Base metals including alloys, all forms, n.e.s	3	6
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	648	373
Grinding and polishing wheels and stones	106	128
Asbestos	20,868	20,333
Barite and witherite	111	2,953
Boron materials:		
Borates and perborates	50	114
Boric acid	2	1
Bromine	128	49
Cement	2,025	2,937
Chalk	149	361
Clays and clay products (including all refractory brick):		
Crude:		
Bentonite	5	1
Fire clay	61	128
Kaolin	16,853	17,778
Andalusite, kyanite, sillimanite	124	306
Other	154	349

See footnotes at end of table.

Table 3.—Argentina: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
NONMETALS —Continued		
Clays and clay products (including all refractory brick) —Continued		
Products:		
Refractory (including nonclay brick)	24,719	18,175
Nonrefractory	3,724	5,260
Cryolite and chiolite	14	72
Diamond:		
Industrial value, thousands	$762	$664
Powder thousand carats	190	368
Diatomite and other infusorial earth	3,027	3,772
Feldspar and fluorspar	200	2
Fertilizer materials:		
Crude:		
Nitrogenous	7,195	5,080
Phosphatic	8,756	11,500
Manufactured:		
Nitrogenous	7,541	4,873
Phosphatic	3,865	14,776
Potassic	13,329	9,491
Mixed	30,432	34,652
Ammonia	(1)	(1)
Graphite, natural	424	573
Iodine	108	9
Magnesite	24,738	24,319
Mica:		
Crude, including splittings and waste	29	19
Worked, including agglomerated splittings	12	25
Pigments, mineral:		
Natural, crude	--	42
Iron oxides, processed	110	166
Precious and semiprecious stones, except diamond thousand carats	3,770	33,545
Pyrite	56	66
Salt and brines	9	10
Sodium and potassium compounds, n.e.s.:		
Caustic soda	72,517	41,840
Caustic potash, sodic and potassic peroxides	511	526
Sodium carbonate, natural and manufactured (soda ash)	190,800	156,870
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	1,184	732
Worked	(1)	(1)
Dolomite, chiefly refractory grade	4,282	4,654
Gravel and crushed rock, n.e.s	26,177	38
Quartz and quartzite	188	446
Sand, excluding metal bearing thousand tons	44	45
Sulfur:		
Elemental:		
Other than colloidal	105,745	80,558
Colloidal	130	107
Sulfuric acid	17	428
Talc, steatite, soapstone, pyrophyllite	328	253
Other:		
Crude	3,828	3,138
Slag, dross, and similar waste, not metal bearing, from iron and steel manufacture	22	25
Oxides, hydroxides, and peroxides of strontium, barium, magnesium	161	169
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	61	32
Carbon black	771	824
Coal, all grades, including briquets thousand tons	807	1,254
Coke and semicoke do	1	1
Hydrogen and rare gases kilograms	863	22,671
Natural gas million cubic feet	49,020	72,651
Peat	12	55
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	22,066	24,141
Refinery products:		
Gasoline do	31	142
Kerosine do	(1)	46
Distillate fuel oil do	3,248	4,201
Residual fuel oil do	948	(1)
Lubricants do	253	159
Other:		
Liquefied petroleum gas do	17,229	25,427
Nonlubricating oils, n.e.s do	1	1
Other do	156	180
Total do	21,866	30,156
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	72,456	42,040

[r] Revised.

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—Argentina's first aluminum smelter, with a capacity of 140,000 tons per year, operated by Aluminio Argentino S.A.I.C. (ALUAR) was able to increase its production because of increased availability of electrical energy from the Futaleufú dam. With demand in 1980 projected at 80,000 tons and the plant operating at full capacity, 60,000 tons of aluminum would be available for export. However, since ALUAR contracted to supply 20,000 tons of aluminum in exchange for imported bauxite, this would leave only 40,000 tons for other foreign markets.

Beryllium.—Argentina continued as the third largest producer of beryl, a beryllium ore, after the U.S.S.R. and Brazil. (The United States is also a significant world producer of the ore and beryllium-copper alloys, but from the mineral bertrandite). Production of high-quality ore containing about 12% BeO has been from an extensive pegmatite zone in the Pampean Ranges. Beryl was mined primarily at the La Viquita deposit in the Province of San Luis and to a lesser extent at the Lux deposit in Córdoba Province. Some beryl-bearing pegmatites are found in the Provinces of Catamarca, La Rioja, San Juan, and farther south in Río Negro.

Copper.—The Compañía Minera Aguilar S.A. (CMA), a subsidiary of St. Joe Minerals Corp., continued development of the El Pachón copper deposit, principally through performing special studies at the tailings dam site and carrying out additional drilling at the mine. Definitive investment and financial plans for the $940 million project were expected to become finalized considering the approval in late 1979 of the new mining promotion law.

Fabricaciones Militares (FM), the Government agency responsible for identifying and exploring new ore deposits and for negotiating with foreign investors to develop them, was evaluating several prospects located in northwestern Argentina: Bajo La Alumbrera (copper, gold, molybdenum), Famatina mining district (copper, molybdenum), Cerro Mercedario (copper, molybdenum), and Basic Rock Area (copper, nickel). Bajo La Alumbrera, located southwest of San Miguel de Tucumán, appeared relatively promising. This deposit, with a copper equivalent grade of 0.85% copper, has reserves estimated at 300 million tons. The project as defined in the prefeasibility study was based on the output of 266,000 tons of concentrate per year containing 23% copper. Evaluation of the prefeasibility study by Kaiser Engineers was nearing completion. The other three projects mentioned were in the early exploration and drilling stage.

Since domestic production of copper is insignificant, Argentina depends on imports of some 45,000 tons per year of copper to meet demand. The development of the El Pachón deposit alone would satisfy internal demand and provide a surplus for export.

Iron Ore.—Argentina imported most of the iron ore required by its steel industry that in 1977 came primarily from Latin America: Brazil - 70%, Chile - 11%, Peru - 10%, and Venezuela - 5%. The remaining iron ore imports were supplied by Liberia, Sweden, and the Republic of South Africa. An experimental shipment of 3,300 tons was received from the El Mutun deposit in Bolivia. Imports of iron ore in 1978 increased because of the startup of Industria Argentina de Aceros, S.A.'s (ACINDAR) direct reduction steel plant and the new raw material mix at the Zapla steel plant.

Argentina's overseas dependency will change significantly with the availability of iron ore from the Sierra Grande underground mine. In 1978, sinking of a 23-foot diameter vertical production shaft to a depth of 1,575 feet was begun at the Sierra Grande Mine. After completion of the shaft a primary ore crusher was installed underground. In December 1978, startup tests were performed on the 12-kilometer ore concentrate slurry pipeline to the pellet plant at the Punta Colorado port. Startup of the pellet plant by Hierro Patagónico de Sierra Grande S.A. (HIPASAM) came after 10 years of effort. Initial shipment of pellets took place in September 1979. At full capacity, production will total 2.5 million tons of iron ore pellets per year.

Consumption of iron ore by the Argentina's steel industry amounted to 2,136,000 tons of which 45% was in pellet form in 1977.[3]

Iron and Steel.—Production of crude steel continued its upward trend in 1978 and 1979, following the drop in output in 1975. At yearend 1978 Argentina's steel capacity amounted to 3.1 million tons of which 2.3 million tons related to blast furnaces and the balance to direct reduction. The State-owned steel company's Sociedad Mixta Siderúrgia Argentina (SOMISA), accounted for 90% of the output from blast furnaces. Two companies, Dalmine Siderca S.A. I y C and ACINDAR had the only direct reduction facilities. During 1978 investments in the steel sector declined to $200 million from $250 million in 1977, but were expected to increase to $274 million in 1979.

SOMISA was in the process of revising its master plan under consultation with the Nippon Steel Corp., to increase steel capacity from 2 to 4.7 million tons per year. To accomplish this, Nippon Steel proposed the installation of a third blast furnace with a capacity of 3,600 tons per day. It was also proposed to increase the capacity of the hot-rolled mill from 1.0 to 1.5 million tons per year. The expanded operation was scheduled for 1984-85.

In August 1978, ACINDAR initiated operations of its 462,000-ton-per-year Midrex direct reduction plant. ACINDAR is totally integrated from iron ore to finished product and the leading steel company in the private sector. ACINDAR has a capacity for 1 million tons of rolled products including merchant bars, wire rod, reinforcing bars, and galvanized welded pipe.

Dalmine Siderca was planning to expand its direct reduction capacity from 320,000 to 700,000 tons per year of sponge iron and to increase its steel capacity to 585,000 tons per year.

In line with Argentina's drop in GDP in 1978, domestic demand for steel products declined an estimated 35%. On the other hand, exports of steel products, mostly to Latin American countries, increased sharply to a new historical record. Please refer to table 4 for pig iron and steel projections.

Table 4.—Argentina: Projection of steel production and consumption of coking coal

(Million metric tons)

	Crude steel	Pig iron[1]	Coking coal consumption		
			Total	Domestic	Imported
1980	4.2	1.9	1.7	0.2	1.5
1985	8.1	5.0	4.4	.4	4.0
1990	14.0	7.5	6.5	.6	5.8
2000	28.0	12.5	10.6	1.0	9.6

[1] Pig iron produced in blast furnaces

Source: Instituto Latinoamericano del Fierro y el Acero (ILAFA), Papers presented to ILAFA Congress in Bogotá, Colombia, Apr. 26-27, 1979, "Coal—79; Mining, Uses and Supply," p. XIII.

Lead, Silver, and Zinc.—Mine output by CMA, as reported in the 1978 annual report of the St. Joe Minerals Corp., declined 19% for lead/silver concentrate and was 14% lower for zinc concentrate. Because of the industrial recession in 1978, CMA shipped only 59,900 tons of zinc concentrate. Lead shipments were close to 1977 levels because of a shipment of 8,400 tons to Brazil.

CMA was planning to drive a new lower level access adit at its El Aguilar Mine to facilitate extraction of available argentiferous lead/zinc sulfide ore reserves and to provide access to areas of deeper mineralization. The Empresa Minera Pan de Azucar, S.R.L. was also a producer of lead, silver, and zinc at its Pan de Azucar Mine in the Province of Jujuy. In November 1979, NL Industries Inc. sold its three Argentine subsidiaries to a private investor in Argentina. The three subsidiaries - National Lead Co., Industries Deriplom S.A., and Corinda S.A. - sold smelt lead, fabricated lead products, and lead oxides.

Magnesium.—National and provincial authorities were cooperating in determining the volume of magnesium chloride at the La Amarga salt lake in the Puelches region of the Province of La Pampa. This zone has the basic infrastructure for the eventual installation of an industrial plant. Argentina consumes metallic magnesium in producing aluminum alloys. Demand of some 1,000 tons per year was met entirely by imports.

Consumption of magnesium compounds for the production of refractory brick amounted to 25,000 tons per year and was imported entirely from Brazil, Greece, and Israel.

Manganese.—The state mining company Yacimientos Mineros Aguas del Dionisio (YMAD) initiated production in August 1978 at its Farallón Negro Mine and plant in Catamarca Province located several kilometers from its copper deposit, Bajo La

Alumbrera. The 25,000 tons per year of manganese concentrate to be supplied by the Farallón Negro operation will partly meet Argentina's supply deficit and reduce imports which have been at the level of 77,000 tons per year. Ore reserves are adequate to permit mining over 25 years with a possible extension to 40 years. Gold and silver will be recovered at Farallón Negro as byproducts.

Titanium.—The commission for the development of Light Metals (Comision para el Desarrollo de Los Metales Livianos-COPEDESMEL) resumed prospecting work on the southern sands of the Province of Buenos Aires that had been initiated in 1961. Argentina is known to have important areas of titaniferous sands all along its Atlantic coastline.

NONMETALS

Cement.—A historic high in cement production was achieved in 1978. Output had been improving steadily since 1976 when cement plants obtained equipment replacements from overseas.

Cía. Sudamericana de Cemento Portland Minetti S.A. received a $9 million loan from the International Finance Corporation (IFC) to build a new 400,000-ton-per-year cement plant at Malagueño in the central Province of Córdoba. At the end of 1979, seven cement companies were operating 17 plants with an installed capacity of 8.65 million tons.

Fluorspar.—Argentina was the third most important producer of fluorspar in Latin America after Mexico and Brazil. About 75% of output came from the Grupo Leachosa deposit in Río Negro Province. The principal producer was the Sierra Grande S.A. In September 1979, the Secretary of Mining approved a private project to install a $10 million beneficiation plant for fluorspar at Puerto Madryn, Province of Chubut, by Minera Patagónica S.A. Completion date was scheduled for 1982.

Sulfur.—Argentina produced only 10% of total demand. Sulfur imports are expected to decrease when the copper projects mentioned above are in production. One of the largest producers was Establecimiento Azufrero Salta controlled by Fabricaciones Militares. The ore, averaging 25% sulfur is mined high in the Andes in Salta Province.

MINERAL FUELS

In mid-1979 the Government of Argentina agreed to undertake a comprehensive energy and resource assessment with the cooperation of the United States under its International Energy Development program. The Energy Coordinating Committee is to be chaired by the Secretariat of Planning in the office of the President. The assessment will be made over a period of 15 to 18 months and initially will focus on energy demand data collection and analysis.

A gasohol (Alconafta) pilot program was launched in July 1979 in Tucumán Province, in a sugar cane growing region.

Coal.—According to projections prepared by the Latin American Iron and Steel Institute (ILAFA) shown in table 4, Argentina is expected to remain heavily dependent on imports to meet the demand of its iron and steel industry for coal of coking quality. SOMISA operated a coking plant with a total of 165 ovens in its steel complex. The last two batteries of 40 ovens each were incorporated in 1973-74. Argentina's steel expansion plans would require additional coking capacity by 1985.

Argentina continued to import its coking coal from the United States (70%) and Poland (20%); the balance of its demand was met domestically from Río Turbio and petroleum coke. Demand for steam coal from Río Turbio was expected to increase with the construction of an important thermoelectric station at Bahia Blanca.

Natural Gas.—Although the amounts of marketed natural gas decreased for the first time in the recent past, after a period of steady growth, imports of natural gas continued to rise. In 1978 imports increased 9% to 79.53 billion cubic feet and were valued at $108 million, an increase of 15% over the 1977 value. Imports of natural gas (mostly from Bolivia) represented 21% of Argentina's total apparent consumption in 1978.

Gas del Estado, a Government agency, completed construction in December 1978 of the gas pipeline connecting the gasfields of Tierra del Fuego (San Sebastián, Cañadón Alfa, Cañadón Beta, and Cañadón Piedras) to the main southern (austral) truckline which leads northward 2,100 kilometers to Buenos Aires. The 205-kilometer pipeline included a 37-kilometer section under the Strait of Magellan from Cabo Espíritu Santo to Cabo Vírgenes. Natural gas from Tierra del Fuego began to flow in early 1979. Ultimate capacity of the pipeline is 212 million cubic feet per day. The National Territory of Tierra del Fuego contributed from existing operations 5.2% of Argentina's crude oil production and 5.3% of its total natural gas production. Gas reserves in the Argentina sector of Tierra del Fuego were estimated at 52 billion cubic meters or 1.8 trillion cubic feet.

The new gas processing plant in Campo Durán in the Province of Salta will permit YPF to recuperate 95% of the propane in the natural gas imported from Bolivia. Basic engineering and construction supervision was provided by Fish International Engineering Inc. of Houston, Tex. Construction and detailed engineering for the turboexpansion plant was accomplished by a consortium of Argentine companies.

New gas deposits were discovered in Loma de La Lata in Neuquén Province. At yearend, Argentina's proved natural gas reserves were estimated at 15.26 trillion cubic feet, a substantial increase.

In July 1978 Gas del Estado changed its status to that of an autonomous state enterprise, the status that YPF had obtained in April 1977.

Petroleum.—As a combined result of increased oil output and decreased apparent domestic consumption, Argentina's self-sufficiency improved to 93% in 1978 compared with the 88% status in 1977. For comparison, in 1965 self-sufficiency was at 78%, growing to 90% by 1970. YPF accounted for 68% of total crude oil production and contractors for 32% compared with the 76% and 24% breakdown, respectively, in 1977. Secondary recovery accounted for 12% of total output.

Much of the increased oil production was related to the renewed efforts of private industry. Amoco Argentina Oil Co. entered into an agreement in 1978 with the Government to invest $57 million in a program of secondary recovery using water injection in the oilfields of Cerro Dragón and Cañadón Grande in Chubut Province, the second most important oil producing area in southern Argentina. Amoco expected to increase total oil recovery by 27 million barrels.

During 1978 and 1979 oil exploration was intensified. Oil discoveries enabled YPF to add 460 million barrels to Argentina's reserves which at yearend 1979 were estimated at 2.4 billion barrels. In 1978 onshore oil discoveries in Mendoza Province included Agua Botada well located south of Malarque as well as Cajón de Los Caballos and Los Volcanes further south. In Neuquén Province still further south, a wildcat discovery was reported by YPF near the Llancanelo field. In Argentina's mountainous northwestern Province of Salta, YPF made an oil and natural gas discovery near Tartagal which required further evaluation. Offshore in 1978, YPF made its first discovery in the San Jorge basin, 17 kilometers east of Comodoro Rivadavia. The Tehuelche well in the continental shelf was the first of five wildcats planned.

In April 1978 the Secretary of Energy made public the long-awaited Risk Contract Hydrocarbon Law No. 21,778. The law authorizes State enterprises to conclude risk contracts for the exploration and development of hydrocarbons and provides the contractors with certain tax and import incentives. It was also announced that 19 areas throughout Argentina would be put up for bid under the new law beginning in the second half of 1978. Included in areas onshore are six in the north around Salta, five in the center west around Neuquén and two in the south in Santa Cruz Province; four areas are offshore: Three off of Tierra del Fuego and one in the Colorado basin opposite Buenos Aires.

Under the new law, the contractors must assume all risks of exploration and development and must bear all capital costs and other investments required in the contract area. The contractors will not acquire any mineral rights over the deposits discovered in the contract area nor over the hydrocarbon extracted. The contractors will be paid in cash per unit of production. Once the internal needs of the country are satisfied and an adequate margin of reserves are ensured, the contractors may be paid in gas or oil. The term for executing exploration contracts may not exceed 7 years offshore and 5 years onshore, although the period may be extended by 2 years to evaluate any discovery. The period for development of production may not exceed 25 years from the date it is determined that a deposit is commercially exploitable. Foreign investments for exploration and development of hydrocarbons will be excluded from the requirements of Foreign Investment Law No. 21282.

On July 3, 1978, YPF awarded a risk contract covering Tierra del Fuego Area I to a group headed by the Argentina company of Bridas S.A., and including ARFRANCO S.A., Deminex Deutsche Erdolver Sorgus Gessellshaft of West Germany, and Total Exploitation S.A. of France. In March 1979 YPF opened the bids for five exploration areas: Three onshore comprised of Acambuco (Salta), Picún Leufú (Neuquén) and Meseta del Guenguel (Chubut/Santa Cruz); and two offshore areas comprised of Río Gallegos and Magallanes (both in the Austral Basin). During the summer of 1979 the

Government approved the bid awards covering the Río Gallegos and Magallanes areas to the Shell Group headed by Shell Hydrocarbona BV and Shell Cía Argentina de Petroleo.

Uranium-Nuclear Energy.—The Comisión Nacional de Energía Atómica (CNEA), founded in 1950, was responsible for the exploration and development of uranium resources and the production of nuclear energy. Plants for processing uranium ore into yellow cake are located in Malargüe (Province of Buenos Aires), Don Otto (Province of Salta), and Los Adobes (Province of Chubut). The Empresa Nuclear Mendoza, a Government entity, was responsible for installing the uranium leaching operation for the Sierra Pintada uranium mining project of CNEA in Mendoza Province.

In 1977 the capacity of the Atucha I nuclear station, started up in 1974, was increased 8% to 367 megawatts. Work continued on the second nuclear station "Embalse" in the Province of Córdoba with a planned gross capacity of 644 megawatts and scheduled for completion by yearend 1980. In April 1979 Argentina received five foreign bids to build 600-megawatt Atucha II near Atucha I, based on natural uranium and heavy water. A contract was awarded for the construction of a heavy water pilot plant at Ezeiza in the Province of Buenos Aires. Bidding for the construction of a heavy water plant at Arroyito in Neuquén Province was scheduled for 1979.

Argentina continued to progress with its program of integrating its operations, from the mining of uranium to the manufacture of nuclear fuel pellets. In October, ACINDAR, carried out an industrial-scale forging of the first zircalloy ingot, a zirconium alloy of tin, chromium, and iron, at its plant in Villa Constitutión, Santa Fe Province. Zircalloy is used to manufacture the sheaths that contain the uranium fuel.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Argentine pesos (M$N) to U.S. dollars at the rate of M$N1,003 = US$1.00, the exchange rate as of Dec. 31, 1978.

[3] Centro de Industriales Siderúrgicas (Buenos Aires). La Siderúrgia Argentina 1977-78. P. 70.

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The Mineral Industry of Australia

By Charlie Wyche[1]

Although the overall upward trend in value of Australia's mineral production prevailed in 1978 and 1979, there were considerable variations in both production and exports of certain commodities. Although these variations were influenced mostly by world market conditions, they were also affected by some changes in the domestic mineral policy. Investment allowances, various tax concessions, and the establishment of import parity prices for crude oil assisted and encouraged many companies during 1978 and 1979. However, exporters and some importing countries were concerned when the Federal Government issued new guidelines for exporting iron ore, coal, bauxite, and alumina. These guidelines were widely criticized as an attempt by the Government to take over commercial negotiations. Permission to develop several major uranium mines was granted by the Federal Government in 1979, and Australia could become a significant world supplier of uranium by the mid-1980's. Exploration for diamond got underway in 1978, and continued at a rapid pace throughout 1979. Most of the activity was concentrated around the Kimberlite pipes in Western Australia.

In 1978, the value of mine and quarry production was a record $4.7 billion,[2] an increase of 4% compared with the $4.5 billion reported for 1977. This figure increased 8% to about $5.1 billion in 1979. The $6.1 billion value added by domestic smelting and other processing of mineral commodities credited the mineral industry with a total product valued of $11.2 billion. This figure represents 9.8% of the $114 billion adjusted gross national product (GNP) in 1979.

The Government granted authority to the States to raise loan funds for infrastructure in 1979. As a result, New South Wales was planning to spend $89 million on improving coal-loading facilities at Port Kembla and $200 million on the Eraring electric power station and associated coal mines. Queensland was planning to invest $210 million in improving coal-loading facilities and various electric powerplant extentions. Victoria was to spend $350 million on the Loy Yang brown coal powerplant and mine. Tasmania would invest $78 million on further hydroelectric works, and Western Australia was planning to borrow $420 million to construct a pipeline to carry North West Shelf gas to Perth and a further $110 million to integrate the electric power supply in the Pilbara iron mining area.

There were strong indications of a revival in domestic mineral exploration and development from the private sector in both 1978 and 1979. Local and overseas companies demonstrated confidence in the future of mining by investing about $810 million in 1978 and about $900 million in 1979. Investors were undoubtedly encouraged when the Government modified its foreign investment guidelines in early 1978. Now, companies with only 25% Australian ownership and an expressed intention of increasing this percentage would be regarded as Australian companies.

PRODUCTION

Mine output of most of the about 70 minerals produced in Australia in 1978 and 1979 was at or above the level for 1977. The main exceptions were iron ore, lead, zinc, nickel, copper, and bauxite in 1978, and titanium and tin in 1979. The decline in iron ore production reflected the continuing recession in the world steel industry. Although the industry did manage to raise deliveries to markets in Europe and to China, which only partially compensated for lower sales to Japan. For the first time since the Australian aluminum industry started to grow in the early 1960's, output of bauxite declined in 1978 but resumed the upward trend in 1979. Industrial disputes at Weipa, where production dropped 20%, was primarily the reason for the decline, but lower demand in exports markets was also a factor. The decline in production of nickel in ore and concentrates in both 1978 and 1979 reflected the closure of the Redross and Windarra mines, the output of which was only partially replaced by the startup of the Agnew Mine. Copper output declined slightly in 1978, but showed a significant gain in 1979. This industry has been severely affected by depressed conditions in the market in recent years. The decline in lead and zinc production in 1978 reflected low ore grades at Mount Isa and reduced output at the New Broken Hill Consolidated Mine.

Western Australia remained the country's largest mineral-producing State, accounting for 36% of the total value of mineral output in 1978 and about 38% in 1979. The value of minerals produced totaled $1.72 billion in 1978, an increase of 1.2% over that of 1977. The main factor in the overall mineral value increase was the quantity of gold produced, since the value of iron ore increased only slightly and value of nickel declined significantly. The value of iron ore production increased from $955 million in 1977 to $961 million in 1978. Alumina value increased by $2 million to $278 million, and nickel ore value dropped approximately $62 million to $186 million. The value of gold production increased $32 million to $74 million, and that of petroleum (crude oil and natural gas) by $34 million to $95 million.

The value of mineral production in Queensland in 1978, the second largest producing State (25% of total value), totaled $1.20 billion, compared with $1.25 billion in 1977; 1978 was the first year since 1964 that the value declined. Various factors such as industrial problems, prices for metals, and marketing arrangements had significant bearing on the value of production. Coal and copper, which earned $634 million and $174 million, respectively, were the principal contributors to the mineral value. Other significant minerals produced in Queensland were bauxite ($76 million), lead ($74 million), zinc ($58 million), silver ($57 million), and tin ($19 million).

New South Wales, with its base metal and coal industries, ranked third in 1978, accounting for 18% of the total national value. Victoria, with substantial brown coal output, was fourth with 13%. Tasmania, South Australia, and the Northern Territory, with a wide variety of minerals such as copper, tin, bauxite, and zinc, contributed the remainder.

Table 1.—Australia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Bauxite, gross weight	24,084	26,086	24,293	[1]27,583
Alumina	6,206	6,659	6,776	[1]7,416
Metal, refined	232	248	263	[1]270
Antimony, Sb content of antimony and lead concentrates	1,892	2,089	1,514	2,074
Bismuth, mine output, metal content	749	932	930	950
Cadmium:				
Mine output, metal content	1,533	1,567	1,528	1,530
Metal, smelter (refined)	649	671	754	800
Cobalt, Co content of zinc and nickel concentrates	[r]545	1,000	1,360	1,540
Columbium-tantalum concentrates, gross weight[3]	124	158	125	163
Copper:				
Mine output, metal content	218,480	221,579	207,714	[1]234,000

See footnotes at end of table.

Table 1.—Australia: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS —Continued				
Copper —Continued				
Metal:				
Smelter:				
Primary	167,346	167,664	164,395	156,700
Secondary	2,977	4,096	2,743	3,000
Refined:				
Primary	160,317	151,955	152,651	[1]138,200
Secondary	[r]28,014	31,013	21,864	[1]34,800
Gold:				
Mine output, metal content troy ounces	[r]502,741	630,155	647,580	[1]588,359
Metal, refined (excluding recovery from scrap) do.	[r]471,844	552,318	578,329	585,000
Iron and steel:				
Iron ore, gross weight thousand tons	93,255	95,923	83,134	[1]89,000
Metal:				
Pig iron do.	7,417	6,753	7,337	[1]7,800
Ferroalloys:[3]				
Ferromanganese, high-carbon	49,927	71,012	71,668	72,000
Ferrosilicon	5,399	18,667	19,051	19,000
Silicomanganese	14,651	23,430	24,494	24,000
Total	69,977	113,109	115,213	115,000
Crude steel thousand tons	7,774	7,313	7,589	[1]8,126
Semimanufactures do.	5,957	6,743	6,975	7,500
Lead:				
Mine output, metal content	397,403	432,204	400,291	[1]415,591
Metal:				
Primary:				
Bullion, for export	160,690	156,403	151,964	[1]160,400
Refined	181,941	181,501	204,022	[1]215,734
Total	342,631	337,904	355,986	386,134
Secondary (excluding remelt)[e]	29,600	[r]36,500	35,100	[1]39,100
Manganese ore, gross weight	[r]2,154	1,384	1,289	[1]1,666
Mercury 76-pound flasks	4	1	[e]2	2
Nickel:				
Mine output, metal content	82,532	85,868	82,359	[1]74,000
Metal, smelter (refined metal and metal content of oxide)	39,868	34,140	37,327	36,408
Platinum-group metals:[4]				
Palladium, metal content troy ounces	7,950	9,581	9,500	8,500
Platinum, metal content do.	3,158	3,697	3,500	3,000
Ruthenium do.	462	225	300	200
Total do.	11,570	13,503	13,300	11,700
Rare-earth metals: Monazite concentrate, gross weight	5,310	8,507	13,484	15,422
Silver:				
Mine output, metal content thousand troy ounces	25,034	27,525	24,934	25,000
Metal, refined do.	8,187	9,006	8,864	8,100
Tin:				
Mine output, metal content	10,611	10,634	11,864	11,400
Metal, refined:				
Primary	5,603	5,561	5,129	5,000
Secondary	255	205	320	325
Titanium concentrates, gross weight:				
Ilmenite thousand tons	959	1,033	1,255	[1]1,142
Leucoxene	[r]12,233	10,621	16,104	20,000
Rutile	389,750	325,281	257,075	[1]277,393
Tungsten, mine output, metal content	1,989	2,358	2,681	[1]3,133
Zinc:				
Mine output, metal content	468,586	491,608	469,284	[1]528,107
Metal, smelter:				
Dust	6,737	6,411	[e]7,000	6,800
Primary	242,635	249,741	290,066	[1]305,394
Secondary[e]	6,600	[r]6,700	4,700	4,700
Zirconium concentrates, gross weight	420,185	398,229	391,606	[1]442,344
NONMETALS				
Abrasives, natural:				
Beach pebble	1,547	1,290	[e]1,400	1,400
Garnet (sales)	95	1,104	1,315	1,500
Asbestos	60,642	50,601	62,383	70,000
Barite	14,133	11,675	10,844	10,500
Cement, hydraulic thousand tons	5,062	5,022	4,993	[1]5,243

See footnotes at end of table.

Table 1.—Australia: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Clays:				
Bentonite and bentonitic clay	11,954	5,603	[e]8,000	12,000
Brick clay and shale thousand tons	9,431	7,885	[e]8,000	9,000
Cement clay and shale do.	[r]395	372	350	380
Damourite clay (sales)	1,334	1,798	1,800	1,900
Fire clay thousand tons	337	349	340	350
Fuller's earth	9	50	[e]45	50
Kaolin and ball clay	69,303	88,884	[e]86,000	90,700
Other[5] thousand tons	425	446	450	475
Diatomite	1,480	1,288	416	514
Feldspar	4,519	1,877	2,770	1,814
Gem stones value, thousands	[r]$60,170	$63,100	$64,000	$64,000
Gypsum thousand tons	942	916	946	1,000
Lime[6]	902,210	857,322	[e]865,000	1,089,000
Magnesite	14,706	18,531	20,402	18,145
Nitrogen, N content of ammonia	307,400	316,500	294,300	310,000
Perlite, crude	3,448	2,115	2,200	2,700
Phosphate rock	275,600	449,631	285,000	--
Pigments, mineral, natural: Ocher	1,025	62	50	50
Pyrite, including cuprous, gross weight	216,749	225,657	141,250	150,000
Salt thousand tons	5,489	4,715	4,665	4,500
Sillimanite	567	550	708	700
Sodium carbonate[6]	155,000	160,000	165,000	165,000
Stone, sand and gravel:				
Construction sand[5] thousand tons	24,264	25,600	[e]26,000	26,000
Gravel[5] do.	15,640	15,483	15,500	16,000
Dolomite do.	589	537	621	675
Limestone:				
For cement do.	7,673	7,399	[e]7,600	8,000
For other uses do.	2,910	3,152	[e]3,200	3,300
Silica in the form of quartz, quartzite, and glass sand do.	1,381	1,302	[e]1,300	1,300
Other:				
Crushed and broken stone do.	53,038	54,398	[e]54,500	54,000
Dimension stone[7] do.	112	84	[e]90	100
Unspecified[8] do.	32,805	33,116	[e]34,000	34,000
Sulfur:				
S content of pyrite	108,204	107,731	67,099	60,000
Byproduct:				
Metallurgy	129,960	121,140	140,000	140,000
Petroleum	6,588	10,590	11,000	11,000
Total	244,752	239,461	218,099	211,000
Talc, soapstone, pyrophyllite	92,097	112,920	151,613	140,614
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Bituminous and subbituminous thousand tons	74,853	78,367	79,880	[1]83,136
Lignite do.	30,940	29,250	32,869	[1]32,544
Total do.	105,793	107,617	112,749	[1]115,680
Coke:				
Metallurgical do.	5,310	4,670	5,003	5,500
Gashouse (including breeze) do.	65	65	65	70
Total do.	[r]5,375	4,735	5,068	5,570
Fuel briquets do.	959	941	1,129	1,200
Gas, natural, marketed million cubic feet	209,380	217,413	258,504	[1]300,425
Natural gas liquids:[9]				
Ethane thousand 42-gallon barrels	961	695	[e]900	1,000
Propane do.	7,252	7,979	[e]8,160	8,500
Butane do.	8,116	8,734	[e]8,840	9,100
Condensate do.	39	41	[e]40	50
Total do.	16,368	17,449	17,940	18,650
Peat do.	4,449	6,433	[e]5,900	6,000
Petroleum:				
Crude do.	152,522	157,157	158,421	[1]161,371
Refinery products:				
Gasoline:				
Aviation do.	297	333	352	[1]427
Motor do.	79,960	86,875	86,957	[1]95,659
Jet fuel do.	13,186	14,001	13,932	[1]14,000
Kerosine do.	2,066	2,069	1,635	[1]3,363

See footnotes at end of table.

Table 1.—Australia: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Distillate fuel oil ------ thousand 42-gallon barrels	51,891	55,702	57,011	[1]52,086
Residual fuel oil ---- do	30,704	29,380	28,738	[1]32,840
Lubricants ---- do	3,358	3,573	3,717	3,800
Other:				
Refinery gas[10] ---- do	727	711	667	700
Liquefied petroleum gas ---- do	4,071	4,522	4,132	[1]3,758
Solvents ---- do	1,455	1,472	1,377	1,400
Bitumen ---- do	2,911	3,340	3,013	3,200
Unspecified ---- do	8,389	7,195	6,768	6,800
Refinery fuel and losses ---- do	16,467	16,525	18,122	18,300
Total ---- do	215,482	225,698	226,421	236,333

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] Reported figure.

[2] Exports (production not officially reported).

[3] Data are for years ending Nov. 30 of that stated for plants owned by The Broken Hill Pty. Co. Ltd.

[4] Western Australia only. Metal content of nickel ore.

[5] Excludes production from Western Australia.

[6] Data are for years ending June 30 of that stated.

[7] Excludes production from Northern Territory and Australian Capital Territory.

[8] Excludes production from Northern Territory, Australian Capital Territory, and Western Australia.

[9] Excludes natural gasoline and liquefied petroleum gas, which are produced on Barrow Island, off the Western Australia coast. An unspecified portion of the liquefied petroleum gas extracted is apparently marketed locally, but this quantity is limited. The bulk of the liquefied petroleum gas and all of the natural gasoline is blended with crude oil and presumably is counted with crude oil from that area. Gross production of liquefied petroleum gas on Barrow Island was as follows, in thousand barrels: 1976—22, 1977—31, 1978—29, and 1979—NA; and of natural gasoline: 1976—21, 1977—26, 1978—33, and 1979—NA. Natural gas liquids output from several gasfields in Western Australia is excluded for similar reasons. Condensate production from these fields was as follows, in thousand barrels: 1976—25, 1977—23, 1978—19, and 1979—NA.

[10] Residual fuel oil equivalent.

TRADE

Minerals and mineral products supplied about 38% of Australia's total export value in 1978 and 40% in 1979. Increased exports and higher prices of some minerals caused export income to increase by 7% to $5.0 billion in 1978. This figure represents a sharp decline when compared with the 30.4% average increase during the preceding 4 years. The reason for the small growth rate in exports was attributed to the depressed world economy that led, in general, to depressed prices. Coal remained Australia's largest export commodity. The value of Australia's exports of coal was $1.51 billion in 1978 and $1.60 billion in 1979, that of iron ore and pellets $921 million and $980, and alumina and bauxite $800 and $820 million; these three commodities represented 30%, 18%, and 16%, respectively, of the 1978 mineral export value. Other large export earners were copper, lead, zinc, mineral sands, gold, nickel, and tin. Collectively, these commodities accounted for 19% of the total export value in 1978.

The value of mineral imports was around $1 billion in 1978; crude oil accounted for about 80% of total value. The other principal import categories were phosphate rock, asbestos, and diamond.

Table 2.—Australia: Exports and reexports of mineral commodities[1] [2]

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS			
Aluminum:			
Oxide and hydroxide, gross weight thousand tons	5,879	6,367	NA.
Metal:			
Scrap	6,787	7,748	Japan 7,054; Pakistan 254; Taiwan 239.
Unwrought	75,533	75,921	Japan 56,503; Philippines 6,493; Thailand 2,065.
Semimanufactures	3,048	3,793	Indonesia 858; New Zealand 858; Singapore 377.
Antimony ore and concentrate, gross weight	1,821	2,065	Belgium-Luxembourg 946; Netherlands 556; United Kingdom 256.
Beryllium ore and concentrate, gross weight	14	--	
Cadmium metal including alloys, all forms	600	567	United States 364; United Kingdom 94; Netherlands 30.
Chromium:			
Chromite ore and concentrate, gross weight	61	168	Singapore 61; Indonesia 52; New Zealand 24.
Oxides and hydroxides	15	12	Mainly to New Zealand.
Columbium and tantalum: Columbite-tantalite concentrate, gross weight	205	166	United States 68; Japan 51; Taiwan 17.
Copper:			
Ore and concentrate, gross weight	145,722	107,722	Japan 97,010; West Germany 7,168; Belgium-Luxembourg 1,848.
Matte	4,615	5,999	Netherlands 2,504; Republic of South Africa 1,993.
Metal including alloys:			
Copper-lead dross and speiss	7,154	5,677	United States 5,152; West Germany 524.
Slag and residue	287	--	
Scrap, including alloy scrap	410	386	Japan 162; United Kingdom 97; India 79.
Unwrought:			
Blister and cement	7,247	7,542	Japan 4,517; West Germany 3,025.
Refined, unalloyed	75,278	65,991	United Kingdom 18,813; West Germany 12,849.
Alloys, including master alloys	23	104	Malaysia 79; Singapore 12; Taiwan 6.
Semimanufactures:			
Unalloyed	19,026	21,670	New Zealand 8,856; Indonesia 2,532; Japan 1,853.
Alloyed	2,338	2,953	Hong Kong 920; Singapore 720; New Zealand 513.
Gold:			
Ore and concentrate, metal content troy ounces	[3]159,275	[4]99,667	NA.
Metal:			
Mint bullion do.	247,657	249,352	Hong Kong 204,757; Japan 25,677; United Kingdom 13,070.
Refined and unrefined bullion do.	21,965	29,392	Hong Kong 21,102; United Kingdom 5,836.
Iron and steel:			
Ore and concentrate thousand tons	80,775	74,691	Japan 56,643; West Germany 3,355; China, mainland, 2,967.
Roasted iron pyrite	7,089	18	Indonesia 11; New Zealand 7.
Metal:			
Scrap thousand tons	544	482	NA.
Pig iron and equivalent materials do.	905	519	China, mainland, 466; Poland 15; Bangladesh 10.
Ferroalloys	3,665	39,103	United States 25,921; Japan 5,375; Malaysia 2,818.
Steel ingots and other primary forms thousand tons	1,887	1,604	Philippines 272; Italy 178; Argentina 160; Hong Kong 105.
Semimanufactures:			
Bars, rods, angles, shapes, sections do.	233	325	China, mainland, 158; Indonesia 43; Singapore 25.
Universals, plates, sheets do.	262	551	China: Mainland 78, Taiwan 126; New Zealand 76; United States 76.
Hoop and strip do.	23	31	New Zealand 25; China, mainland, 2; Pakistan 2.
Rails and accessories do.	22	6	United States 5; Christmas Island 1.
Wire do.	28	12	New Zealand 5; Papua New Guinea 1; United States 1.
Tubes, pipes, fittings do.	42	58	NA.
Castings and forgings, rough do.	2	2	Singapore 1.
Total do.	612	985	

See footnotes at end of table.

Table 2.—Australia: Exports and reexports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS —Continued			
Lead:			
Ore and concentrate, gross weight	69,048	171,997	France 40,429; Belgium-Luxembourg 35,602; United States 32,324.
Slag and residue	13,403	2,588	West Germany 979; Japan 698; Netherlands 467.
Oxides	4,024	4,624	Malaysia 1,055; China, mainland, 1,044; Thailand 703.
Metal including alloys:			
Scrap	1,336	5,461	Taiwan 3,449; Republic of Korea 701; Malaysia 578.
Unwrought:			
Lead-silver bullion, Pb content	156,794	157,915	United Kingdom 130,554; Netherlands 12,000; Belgium-Luxembourg 9,331.
Refined	132,493	138,595	India 28,806; United States 18,839; United Kingdom 18,789.
Other	7,283	8,762	Malaysia 2,661; New Zealand 2,436; Taiwan 1,111.
Semimanufactures	656	1,118	Iran 700; Singapore 211; Malaysia 75.
Magnesium oxide	2,832	3,320	United States 1,453; New Zealand 1,375; Philippines 342.
Manganese ore[3]	817	436	Mainly to New Zealand
Nickel:			
Ore and concentrate value, thousands	$10,440	$7,831	NA.
Matte, speiss, similar materials do.	$184,975	$161,916	NA.
Metal including alloys:			
Unwrought do.	$46,755	$25,442	NA.
Semimanufactures do.	$32,291	$17,226	NA.
Platinum-group metals troy ounces	76,100	64,290	United Kingdom 51,358; Hong Kong 11,293.
Rare-earth metals: Monazite concentrate, gross weight	5,075	7,793	France 5,616; United States 2,176.
Silver:			
Concentrate and lead-silver bullion, Ag content thousand troy ounces	[3]15,232	[4]15,010	NA.
Metal:			
Refined bullion do.	4,147	3,293	Japan 1,771; United Kingdom 1,178; Singapore 150.
Other metal including alloys value, thousands	$1,818	$2,295	New Zealand $1,380; Singapore $362; Hong Kong $196.
Tin:			
Ore and concentrate, gross weight	13,575	20,672	Malaysia 17,018; United Kingdom 2,991; Belgium-Luxembourg 663.
Oxides	14	9	Japan 4; United States 4; New Zealand 1.
Metal including alloys:			
Unwrought	1,891	2,821	United Kingdom 1,568; Netherlands 938; New Zealand 235.
Semimanufactures	1,174	374	Papua New Guinea 303; New Zealand 54.
Titanium ores and concentrates, gross weight:			
Ilmenite (excluding beneficiated ilmenite) thousand tons	1,167	1,003	United States 330; United Kingdom 220; France 127.
Leucoxene	11,962	12,091	United States 11,686; France 220; Belgium-Luxembourg 148.
Rutile	305,557	318,279	United States 148,180; United Kingdom 59,410; Netherlands 32,748.
Tungsten ores and concentrates, gross weight:			
Scheelite	3,101	3,366	West Germany 1,693; Sweden 562; U.S.S.R. 334.
Wolframite	525	786	West Germany 464; United Kingdom 145; Japan 93.
Uranium and thorium ores and concentrates, excluding monazite	750	7,609	France 5,491; United States 2,118.
Vanadium ore and concentrate	165	88	Mainly to Taiwan.
Zinc:			
Ore and concentrate, gross weight	408,234	417,745	Japan 194,513; Netherlands 100,702; United Kingdom 38,708.
Oxides	368	323	Philippines 171; Hong Kong 67; New Zealand 34.
Metal including alloys:			
Slag and residue	6,494	5,485	Taiwan 3,238; Republic of South Africa 1,475; India 178.
Unwrought	170,075	184,315	Indonesia 34,374; United States 33,706; Taiwan 26,257.
Semimanufactures	2,798	3,717	New Zealand 2,934; Taiwan 370; Singapore 186.
Zirconium ore and concentrate, gross weight	351,835	361,549	Japan 86,724; United States 69,725; Netherlands 54,548.

See footnotes at end of table.

Table 2.—Australia: Exports and reexports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS —Continued			
Other:			
Ores and concentrates of base metals[6] value, thousands	$126,453	$119,855	NA.
Waste and scrap containing nonferrous metals	6,388	2,388	United Kingdom 1,135; Japan 230; India 228.
Oxides, hydroxides, peroxides of metals value, thousands	$6,503	$9,449	United States $1,334; Indonesia $1,038; Taiwan $935.
Metals including alloys, all forms:			
Magnesium and beryllium	55	31	New Zealand 26; Singapore 2; United States 2.
Molybdenum and tungsten	6	([7])	NA.
Base metals, n.e.s value, thousands	$289	$147	Taiwan $35; United States $29; New Zealand $25.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc. do	$121	$57	Philippines $20; Thailand $19; Papua New Guinea $6.
Dust and powder of precious and semiprecious stones do	$91	$22	Mexico $17; United States $4.
Grinding and polishing wheels and stones do	$394	$341	New Zealand $200; Singapore $25; Thailand $22.
Asbestos, crude and fiber	28,011	32,145	Japan 11,276; Mexico 2,747; Ecuador 2,423.
Barite and witherite	873	1,467	New Zealand 969; Republic of South Africa 200; Philippines 178.
Cement, hydraulic	39,914	6,914	Papua New Guinea 6,309; Christmas Island 301; Philippines 128.
Clays and clay products (including all refractory brick):			
Crude	8,372	12,044	United Kingdom 5,567; Indonesia 3,441; Japan 1,524.
Products:			
Refractory:			
Brick	2,824	2,759	New Zealand 832; Indonesia 566; United Kingdom 377.
Other value, thousands	$1,232	$1,265	New Zealand $481; Indonesia $379; New Caledonia $165.
Nonrefractory do	$230	$344	Papua New Guinea $116; New Zealand $54; Fiji $44.
Diamond:			
Gem, not set or cut carats	12,182	13,597	Israel 3,471; Hong Kong 3,448; Belgium-Luxembourg 2,865.
Industrial do	256,218	297,018	Ireland 134,693; United States 90,597; Philippines 33,761.
Fertilizer materials:			
Crude	184,915	298,478	Japan 185,299; Republic of Korea 34,000; Philippines 24,150.
Manufactured:			
Nitrogenous	1,160	7,228	New Zealand 6,942; Papua New Guinea 90; Sweden 71.
Phosphatic (excluding basic slag)	169	249	Papua New Guinea 140; Indonesia 104.
Potassic	--	33	British Solomon Islands 30; Hong Kong 1; New Zealand 1.
Other, including mixed	349	787	Papua New Guinea 359; New Zealand 312; Western Samoa 100.
Ammonia value, thousands	$1,947	$170	New Zealand $144; Papua New Guinea $10; Fiji $9.
Gem stones, except diamond:			
Opal do	$22,974	$20,134	Hong Kong $9,287; United States $3,799; Japan $3,120.
Sapphire do	$3,646	$6,625	Thailand $4,389; Hong Kong $768; United Kingdom $506.
Other do	$1,537	$1,878	Hong Kong $592; New Zealand $221; Papua New Guinea $160.
Gypsum	209,063	193,750	New Zealand 94,165; Indonesia 40,672; Mozambique 24,491.
Lime: Quicklime, slaked lime, hydraulic lime	1,170	37	Papua New Guinea 34.
Magnesite	65	123	United Kingdom 71; New Zealand 44; Malaysia 4.

See footnotes at end of table.

Table 2.—Australia: Exports and reexports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
NONMETALS —Continued			
Mica, worked .... value, thousands..	$67	$89	New Zealand $66; Indonesia $19; Malaysia $3.
Pigments, mineral:			
Natural, crude	23	53	Singapore 18; Papua New Guinea 13; Malaysia 9.
Iron oxides, processed	32	28	Papua New Guinea 21; New Zealand 5.
Pyrite, unroasted, gross weight[8]	248	261	New Zealand 166; Malaysia 54; Papua New Guinea 40.
Salt and brines .... thousand tons..	4,092	4,154	Japan 3,200; Taiwan 422; Republic of Korea 362.
Sodium and potassium compounds, n.e.s.:			
Caustic soda..................	2,593	301	Indonesia 72; Fiji 71; New Zealand 63; Philippines 36.
Caustic potash	33	3	Papua New Guinea 2.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	757	193	Taiwan 141; Japan 36; New Zealand 11.
Worked....... value, thousands..	$38	$120	New Zealand $97; Philippines $8.
Sand and gravel and crushed rock thousand tons..	1,065	467	Japan 375; Republic of Korea 44; United States 31.
Sulfuric acid	225	120	Papua New Guinea 42; Sri Lanka 18; Bahrain 16.
Talc, steatite, soapstone, pyrophyllite	63,445	93,104	Japan 78,532; Netherlands 10,553; New Zealand 2,112.
Other:			
Crude:			
Quartz, mica, feldspar, fluorspar, cryolite	662	81	New Zealand 77.
Refractory materials, n.e.s	47	20,037	Taiwan 19,952; New Zealand 67.
Other .... value, thousands..	$161	$521	West Germany $398; United States $96.
Oxides and hydroxides of magnesium, strontium, barium..................	155	8	Japan 3; Fiji 2; New Zealand 2.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s .... value, thousands..	$4,484	$4,670	Canada $2,612; Iran $408; Singapore $397.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	31,988	42,799	Indonesia 13,808; Thailand 10,124; New Zealand 7,301.
Coal and peat, including briquets:			
Bituminous coal and briquets thereof thousand tons..	34,441	45,163	Japan 26,427; Netherlands 1,957; France 1,763.
Lignite and peat and briquets thereof ...	24,497	29,049	Japan 27,432; Republic of Korea 1,519.
Coke and semicoke..................	188,794	149,435	Philippines 106,933; Belgium-Luxembourg 24,601; Vietnam 10,038.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels..	1,297	1,324	New Zealand 1,267; Singapore 57.
Refinery products:			
Gasoline ....do.....	1,758	2,114	New Zealand 1,607; Fiji 295; Singapore 101.
Jet fuel ....do.....	2,032	1,826	New Zealand 1,288; Fiji 509; Mozambique 23.
Kerosine ....do.....	242	364	New Zealand 244; Fiji 107.
Distillate fuel oil ....do.....	2,880	4,685	New Zealand 2,022; Japan 1,024; Singapore 630.
Residual fuel oil...........do.....	4,677	1,460	Singapore 708; United States 363; Japan 229.
Lubricants ....do.....	1,288	1,742	New Zealand 366; Indonesia 279; Singapore 262.
Other ....do.....	264	226	New Zealand 87; Bahrain 58; Taiwan 31; Singapore 28.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals value, thousands..	$5,178	$1,713	Japan $1,000; Singapore $378; Philippines $173.

NA Not available.

[1] Data are for fiscal years beginning July 1 of that stated.

[2] Values are in Australian dollars.

[3] Australian Mineral Industry Quarterly. V. 30, No. 2 for quarters ending September and December 1976; and V. 31, No. 1 for quarters ending March and June 1977.

[4] Australian Mineral Industry Quarterly. V. 31, No. 2 for quarters ending September and December 1977; and V. 32, No. 1 for quarters ending March and June 1978.

[5] The value of an unreported amount of manganese ore is included in "Other ores and concentrates of base metals."

[6] Includes the value of an unreported amount of bauxite and manganese ore.

[7] Less than 1/2 unit.

[8] Includes elemental sulfur, other than colloidal.

Table 3.—Australia: Imports of mineral commodities[1] [2]

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS			
Aluminum:			
Oxide and hydroxide	6,335	4,626	Japan 2,353; United States 1,085; Austria 306.
Metal including alloys:			
Scrap	1,453	1,369	New Zealand 1,221; United Kingdom 133.
Unwrought	347	178	United Kingdom 176; France 1; New Zealand 1.
Semimanufactures	5,199	4,150	United States 1,961; United Kingdom 588; New Zealand 482.
Antimony metal including alloys, all forms	26	117	United Kingdom 60; China, mainland, 57.
Arsenic trioxide and pentoxide	1,220	908	United Kingdom 401; France 285; Sweden 144.
Beryllium metal including alloys, all forms value	$2,000	$38,000	United States $20,000; Japan $17,000.
Bismuth metal including alloys, all forms	17	18	West Germany 7; United Kingdom 6; Japan 3.
Chromium:			
Chromite	6,850	13,466	Philippines 10,759; Republic of South Africa 1,709; United States 500.
Oxide, hydroxide, trioxide	866	737	U.S.S.R. 311; United States 220; West Germany 195.
Metal including alloys, all forms	63	26	Mainly from Japan.
Cobalt:			
Oxide and hydroxide	6	7	Canada 5; United States 2.
Metal including alloys, all forms	32	48	United Kingdom 27; Belgium-Luxembourg 17; United States 3.
Copper:			
Ore and concentrate	3	355	Papua New Guinea 350; New Caledonia 5.
Copper sulfate	4,052	197	United Kingdom 155; New Zealand 39.
Metal including alloys:			
Scrap:			
Unalloyed	541	329	New Zealand 198; Papua New Guinea 59; Indonesia 16.
Alloyed	520	458	United Kingdom 200; New Zealand 163; Papua New Guinea 77.
Unwrought	517	204	Papua New Guinea 85; Belgium-Luxembourg 28; United Kingdom 23.
Semimanufactures value, thousands	$12,538	$11,218	Japan $3,759; United Kingdom $3,250; United States $1,718.
Gold:			
Ore and concentrate do	$39	$25	Fiji $14; Papua New Guinea $11.
Metal:			
Crude bullion, Au content troy ounces	61,204	44,262	Fiji 38,991; Papua New Guinea 4,952.
Refined bullion do	3,523	7,319	Switzerland 6,023; Hong Kong 592.
Other, including waste and sweepings value, thousands	$1,818	$1,826	Papua New Guinea $952; Italy $265; New Zealand $164.
Iron and steel:			
Ore and concentrate, including roasted pyrite	30,154	27,590	Mainly from Canada.
Metal:			
Scrap	191	659	Papua New Guinea 466; New Zealand 190.
Sponge iron, powder, shot	6,362	6,620	Sweden 2,609; India 1,503; Japan 1,486.
Spiegeleisen	48	60	All from West Germany.
Ferroalloys:			
Powder:			
Ferromanganese	118	191	Japan 164; Brazil 17; France 10.
Other	260	84	Brazil 59; Japan 14; France 3; United Kingdom 3.
Shot:			
Ferrochromium	12,136	12,967	Republic of South Africa 8,950; Sweden 2,865; Japan 750.
Ferromanganese	5,518	966	Japan 935; France 21; West Germany 10.
Ferromolybdenum	170	201	United States 141; United Kingdom 30; Austria 27.
Ferrosilicon	7,664	5,186	Republic of South Africa 2,293; Philippines 1,000; Japan 669.
Ferronickel	24	19	All from New Caledonia.
Other	2,845	1,723	United Kingdom 882; Spain 256; France 193.
Steel, primary forms	671	672	Japan 350; Sweden 113; Philippines 85.

See footnotes at end of table.

Table 3.—Australia: Imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Semimanufactures:			
Bars, rods, angles, shapes, sections	71,844	65,521	Japan 52,077; United Kingdom 4,000; Sweden 2,793.
Universals, plates, sheets	208,403	311,292	Japan 254,005; Republic of Korea 36,759; West Germany 10,572.
Hoop and strip	37,027	22,224	Japan 16,809; United Kingdom 2,229; United States 1,172.
Rails and accessories	7,444	1,618	Japan 992; Belgium-Luxembourg 354; West Germany 236.
Wire	12,896	10,970	Japan 7,298; United Kingdom 1,244; France 1,011.
Tubes, pipes, fittings[3]	96,162	118,850	Japan 67,614; United Kingdom 5,925; Republic of Korea 5,349.
Castings and forgings, rough value, thousands	$397	$667	United States $443; United Kingdom $113; Taiwan $86.
Lead:			
Oxides	37	68	Mexico 36; United States 14; Republic of South Africa 10.
Metal, including alloys:			
Scrap	508	202	Singapore 122; United Kingdom 37; Papua New Guinea 23.
Unwrought and semimanufactures	173	254	New Zealand 184; United Kingdom 56; United States 13.
Magnesium metal including alloys, all forms	2,019	1,818	United States 1,196; Norway 512; Canada 83.
Manganese:			
Ore and concentrate:			
Battery grade	1,216	2,657	All from United States.
Metallurgical grade	81	--	
Oxides	1,070	1,456	Japan 1,090; United States 360.
Metal including alloys, all forms	1,308	899	Republic of South Africa 553; Japan 315; France 30.
Mercury 76-pound flasks	1,169	1,389	China, mainland, 790; Spain 340; Sweden 150.
Molybdenum:			
Ore and concentrate	252	314	Canada 148; West Germany 79; United States 49.
Metal including alloys, all forms:			
Wire	11	5	United States 4; United Kingdom 1.
Other value, thousands	$50	$258	West Germany $153; United States $71; Austria $24.
Nickel:			
Matte, speiss, similar materials	2,414	3,465	Canada 3,463; United Kingdom 2.
Metal including alloys:			
Scrap	17	5	All from United States.
Unwrought	1,525	2,352	Canada 2,301; United States 16; Finland 11.
Semimanufactures	989	1,296	United States 325; Japan 229; United Kingdom 169.
Platinum-group metals and silver:			
Ores and concentrates kilograms	434	1	All from Fiji.
Waste and sweepings value, thousands	$491	$656	Hong Kong $580; Singapore $34; New Zealand $29.
Metals including alloys:			
Platinum-group kilograms	23,330	25,124	West Germany 22,484; United Kingdom 1,858.
Silver do	3,261	3,331	France 716; United Kingdom 629; Fiji 387.
Silicon metal	3,876	2,006	Republic of South Africa 1,318; Sweden 317; Italy 96.
Tin:			
Oxides	15	5	United Kingdom 3; West Germany 1; Japan 1.
Metal including alloys:			
Scrap	3	19	All from New Zealand.
Unwrought	20	216	Malaysia 2[illegible]5; Brazil 5; West Germany 5.
Semimanufactures	12	16	United Kingdom 8; United States 7; Canada 1.
Tungsten metal including alloys, all forms	4	6	France 1; West Germany 1; United States 1.
Zinc:			
Ore and concentrate	--	13	All from West Germany.
Oxides	610	981	United States 283; Canada 273; West Germany 246.
Metal including alloys, all forms	803	99	New Zealand 70; United States 25.

See footnotes at end of table.

Table 3.—Australia: Imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS —Continued			
Other:			
Ores and concentrates:			
Of columbium, tantalum, titanium, vanadium, zirconium	19	38	Mainly from United Kingdom.
Of base metals, n.e.s	50	2,219	Philippines 2,000; Republic of South Africa 100; United Kingdom 58.
Ash and residue containing nonferrous metals	1,228	306	New Zealand 253; Fiji 26; United States 24.
Oxides, hydroxides, peroxides of metals n.e.s	718	836	Canada 165; United Kingdom 157; United States 141.
Metals including alloys, all forms:			
Metalloids	2,320	2,299	United Kingdom 917; Canada 883; United States 304.
Alkali, alkaline-earth, rare-earth metals	79	80	United Kingdom 31; West Germany 23; United States 16.
Base metals including alloys, all forms, n.e.s	46	70	United States 30; Japan 23; United Kingdom 10.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	743	630	United States 231; New Zealand 105; West Germany 90.
Grinding and polishing wheels and stones	1,426	1,124	Netherlands 228; Japan 192; United Kingdom 187.
Asbestos	70,731	55,265	Canada 46,839; Republic of South Africa 7,294; United States 923.
Barite and witherite, natural and ground	1,909	875	China, mainland, 753; Indonesia 67; West Germany 55.
Boron materials:			
Crude natural borates	21	6	United States 4.
Oxide and acid	3,572	3,061	United States 3,050; China, mainland, 10.
Cement[4]	49,043	28,729	Japan 13,819; United Kingdom 5,872; Singapore 3,135.
Chalk	8,314	5,091	United Kingdom 3,225; New Zealand 948; France 494; Japan 420.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	11,751	19,403	United States 18,675; Singapore 661; Indonesia 46.
Fire clay and ball clay	3,200	1,875	United Kingdom 1,482; United States 190; Japan 175.
Andalusite, mullite, dinas earth, kyanite, sillimanite	1,346	539	United States 505; Republic of South Africa 28.
Kaolin (china clay)	2,188	11,075	United States 8,380; Japan 1,500; United Kingdom 1,195.
Other	31,298	24,985	United States 23,878; China, mainland, 502; United Kingdom 315.
Products:			
Refractory (including nonclay brick)[5]	25,582	31,362	Japan 16,829; United Kingdom 5,459; United States 4,088.
Nonrefractory ... value, thousands	$36,766	$39,654	Japan $18,195; Italy $12,513; United Kingdom $1,375.
Cryolite and chiolite	164	158	Denmark 142; Japan 16.
Diamond:			
Gem, not set or strung ... carats	91,336	80,990	Israel 26,509; Belgium-Luxembourg 23,755; India 13,357.
Industrial ... do.	328,790	282,479	United Kingdom 171,549; Republic of South Africa 57,541.
Dust ... do.	688,363	571,346	Ireland 284,194; United States 240,069; Republic of South Africa 39,591.
Diatomite and other infusorial earth	6,530	6,619	United States 6,248; Mexico 147; Japan 128.
Feldspar, leucite, nepheline	12,296	12,661	Canada 11,629; Norway 693; China, mainland, 185.
Fertilizer materials:			
Crude:			
Nitrogenous	1,545	2,219	Belgium-Luxembourg 2,074; West Germany 145.
Phosphatic ... thousand tons	1,329	1,610	Nauru 802; Christmas Island 487; Gilbert and Ellice Islands 279.
Manufactured:			
Nitrogenous	22,230	23,321	Indonesia 9,920; Italy 6,050; Japan 3,725.
Phosphatic, excluding slag	20,676	10,082	United States 10,008; Japan 72.
Potassic	165,471	161,897	Canada 92,849; United States 67,008.
Other, including mixed	49,964	24,995	United States 20,132; West Germany 3,264.

See footnotes at end of table.

Table 3.—Australia: Imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
NONMETALS —Continued			
Fertilizer materials —Continued			
Ammonia value	$6,000	$5,000	United States $4,000.
Fluorspar	36,861	26,132	China, mainland, 12,381; Republic of South Africa 11,301; Thailand 2,111.
Graphite, natural	1,330	2,073	Sri Lanka 1,074; China, mainland, 402; Republic of Korea 341.
Gypsum and plasters	1,113	11,745	Japan 10,561; United Kingdom 836; United States 215.
Iodine	18	26	Japan 14; United States 10; Canada 1; Indonesia 1.
Lime value, thousands	$24	$184	Japan $157; United Kingdom $13; Canada $11.
Magnesite	22	6,022	Japan 5,927; United States 66; India 20.
Mica:			
Crude, including splittings and waste	1,186	830	India 383; China, mainland 250; Republic of South Africa 168.
Worked, including agglomerated splittings value, thousands	$377	$318	United States $96; United Kingdom $78; West Germany $74.
Pigments, mineral:			
Natural, crude	1,642	933	United Kingdom 285; Austria 258; West Germany 211.
Iron oxides, processed	10,517	8,563	West Germany 6,664; Spain 778; United Kingdom 647.
Precious and semiprecious stones, except diamond:			
Natural value, thousands	$10,882	$6,812	Thailand $1,417; Hong Kong $806; West Germany $731.
Manufactured do	$340	$404	Switzerland $132; West Germany $106; Austria $56.
Salt	23,369	30,089	Mexico 22,511; United Kingdom 5,381; New Zealand 1,484.
Sodium and potassium compounds, n.e.s.:			
Caustic soda value, thousands	$48,297	$56,193	NA.
Caustic potash and sodic and potassic peroxides	2,486	2,406	Japan 1,316; India 380; West Germany 266.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	2,217	1,923	Italy 1,690; Yugoslavia 84; Portugal 75.
Slate	1,091	1,634	Republic of South Africa 1,128; Italy 296; India 87.
Other	1,862	1,658	Republic of South Africa 1,013; Finland 307; India 167.
Worked value, thousands	$1,887	$2,185	Italy $984; Taiwan $521; Spain $197; United Kingdom $150.
Dolomite	208	39	New Zealand 16; United States 16.
Gravel and crushed rock	13,453	916	Italy 643; United Kingdom 59; New Zealand 54.
Limestone, except dimension thousand tons	1,175	1,320	Japan 1,272; Philippines 48.
Quartz and quartzite	441	283	Sweden 158; West Germany 87.
Sand, excluding metal bearing	551	1,360	Republic of South Africa 514; Sweden 372; United States 253.
Sulfur:			
Elemental:			
Other than colloidal	315,432	475,708	Canada 448,965; Iran 26,380.
Colloidal	90	137	West Germany 53; Netherlands 39; Yugoslavia 22.
Sulfuric acid, including oleum	16	645	Japan 642; United States 2.
Talc, steatite, soapstone, pyrophyllite	265	444	China, mainland, 200; United States 172; Norway 41.
Vermiculite	4,786	1,571	Republic of South Africa 1,274; China, mainland, 282.
Other:			
Crude	583	441	West Germany 116; China, mainland, 90; Japan 68.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	44	23	New Zealand 12; West Germany 8; Fiji 3.
Slag and ash, n.e.s	73	40	United Kingdom 29; Fiji 9.
Oxides and hydroxides of magnesium, strontium, barium	17,394	7,332	Japan 6,769; United States 473; United Kingdom 84.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s value, thousands	$957	$1,297	United Kingdom $572; United States $500; Japan $82.

See footnotes at end of table.

Table 3.—Australia: Imports of mineral commodities[1] [2]—Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	787	946	United States 626; Trinidad and Tobago 263; United Kingdom 32.
Carbon black	714	789	United States 481; United Kingdom 157; West Germany 112.
Coal, all types, including briquets	11,733	12,910	Republic of South Africa 12,431; United States 217.
Coke and semicoke	3,753	3,378	All from United States.
Peat	6,070	21,076	West Germany 19,378; New Zealand 713; Ireland 322.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	63,477	70,833	Saudi Arabia 31,126; Kuwait 11,589; Iraq 10,126.
Refinery products:			
Gasoline do	9,125	5,687	Bahrain 1,261; Singapore 1,126; Italy 1,000.
Kerosine and jet fuel do	406	282	Singapore 153; United States 67; People's Democratic Republic of Yemen 32.
Distillate fuel oil do	5,169	6,575	Singapore 5,617; Bahrain 385; Kuwait 225.
Residual fuel oil do	12,113	12,616	Kuwait 6,094; Bahrain 3,421; Singapore 3,101.
Lubricants do	247	329	United States 162; Netherlands Antilles 114; United Kingdom 33.
Mineral jelly and wax do	128	56	China, mainland, 24; United States 10; Japan 6.
Other:			
Liquefied petroleum gas do	1	1	NA.
Bitumen, bituminous mixtures, other residues do	35	31	Singapore 22; United States 5; United Kingdom 3.
Petroleum coke do	587	647	United States 594; Canada 53.
Unspecified do	85	26	Singapore 8; United Kingdom 7; United States 7.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals value, thousands	$4,339	$5,685	United States $3,382; Iran $2,120.

NA Not available.

[1] Data are for fiscal years beginning July 1 of that stated.

[2] Values are in Australian dollars.

[3] Excludes quantities valued at $6,725,000 in 1976 and $12,046,000 in 1977.

[4] Excludes quantities valued at $2,148,000 in 1976 and $1,598,000 in 1977.

[5] Excludes quantities valued at $322,000 in 1976 and $211,000 in 1977.

COMMODITY REVIEW

METALS

Aluminum, Alumina, and Bauxite.—Australia's bauxite production declined for the first time in 15 years during 1978 but resumed the upward trend in 1979. The decline was attributed to industrial unrest at the mine of one major producer. For some years, Australia has been the world's leading producer of bauxite from mines located at Weipa, Queensland; Gove, Northern Territory; and the Darling Range, Western Australia. Production of alumina, however, increased slightly in both 1978 and 1979 as a result of greater utilization of capacity at three refineries. Full production capacity was reported by Alcoa of Australia Ltd. at Kwinana and Pinjarra, both located in Western Australia, and by Nabalco Pty. Ltd. at Gove. Aluminum production also increased as smelters at Point Henry, Victoria, and Kurri Kurri, New South Wales, operated at full capacity.

The market was buoyant throughout 1979, although some weakness in the demand for alumina was reported in the second half of 1979. The domestic demand for primary metal did not expand as expected, but the smelters were fully operational as export orders improved. Several price increases in 1979 helped producers to offset rising production costs, however, one company reported a drop in profits.

At Weipa, on Cape York Peninsula, Comalco Pty. Ltd. produced about 15% of the Western World's total bauxite output. At Comalco, which is owned 45% by Conzinc Riotinto of Australia Ltd., 45% by Kaiser Aluminum and Chemical Corp. and 10% by the Australian public, output was slightly above that of 1977. Both production of bauxite and shipments from Weipa in 1978 were below the level of 1977 owing to industrial dispute that restricted operations at the docks. In each year, 1978 and 1979, the company shipped about 9 million tons of bauxite to international markets, principally Japan and Europe. The largest single outlet was the Gladstone alumina refinery operated by Queensland Alumina Ltd. (QAL). Comalco supplied the total bauxite demand for QAL, which in 1978 totaled about 4.4 million tons and 5 million tons in 1979. All of Alcoa's bauxite output was converted to alumina at nearby refineries located at Pinjarra and Kwinana, which have a combined annual capacity of 3.4 million tons. Roughly half of Nabalco's bauxite was exported; the remainder was refined to alumina in an adjacent refinery at Gove that has an annual capacity slightly in excess of 1 million tons.

Australia's three aluminum smelters operated at near capacity levels throughout 1978 and 1979, and production increased slightly during both years. Production of primary aluminum by Comalco's smelter, located at Bell Bay, Tasmania, was appreciably higher than that of 1977. This increase resulted from the new potline commissioned in 1978. The annual rated capacities of the three plants were Comalco at Bell Bay, 112,000 tons; Alcoa at Point Henry, 45,000 tons; and Alcan at Kurri Kurri, 45,000 tons. Expansion work on the Alcan plant continued, and in 1979 its capacity increased to 67,900 tons annually.

Prospects for Australia to occupy a more prominent position in the world aluminum smelting industry continued to improve. Higher prices for crude petroleum have made some oil-fired power stations uneconomic as sources of energy for aluminum production. As a result, Australia's extensive coal resources were recognized as having valuable potential for thermal power generation. Consequently, a number of new aluminum smelting ventures, which would use power from coal-fired stations, were under consideration. In early 1978, Comalco decided to proceed with the construction of a 180,000-ton-per-year plant at Gladstone. The project will cost $500 million and was scheduled to be onstream in mid-1982. Nabalco began a feasibility study for a smelter to use alumina from Gove. Alumax Pty. Ltd. was also committed to a feasibility study for a smelter to be built near Newcastle, New South Wales. Alumax planned a production capacity of 200,000 tons annually, bigger than any Australian plant now operating. Alumax is controlled 50% by Alumax of the United States, 45% by Mitsubishi, and 5% by Nippon Steel.

Apart from the smelter developments, Alcoa planned to build a $200 million, 200,000-ton-per-year alumina plant at Wagerup, south of Perth. Nabalco was modifying its Gove alumina plant to produce sandy alumina, for which contracts have already been obtained. The company has also formed a subsidiary to make a study of the feasibility of establishing a smelter in the immediate vicinity of the alumina plant.

Australia has very large resources of bauxite, and production from Comalco's Weipa deposit supplies approximately 15% of the Western World's requirements. The company's proved, probable, and possible ore reserves at the beginning of 1978 comprised 3.1 billion tons, with recoverable bauxite content of 2.5 billion tons. The grade of recoverable bauxite in the 599 million tons of proved reserves ranged from 53% to 56% alumina. The alumina content in the probable reserves was in the range of 48% to 56% alumina.

Copper.—Improvement in copper demand in late 1978 and throughout 1979, coupled with lower than expected world copper production, caused existing and potential Australian producers to review plans for reopening old mines and developing new ones. The first project will probably involve Peko-Wallsend Ltd., which for some time has been examining the feasibility of rebuilding its Tennant Creek copper smelter. A decision to proceed with the $20 million project is expected early in 1980. Consolidated Gold Fields of Australia Ltd. (CGFA) was another producer that expected to resume production, together with Mitsubishi Development Pty. Ltd., at the Gunpowder Mine.

Although the Australian copper industry showed signs of improvement in late 1978 and throughout 1979, overall production in the various sectors during the 2 years was mixed. Mine output in 1978 declined from the 1977 level, but output in 1979 increased significantly above the levels for 1978 and also those of 1977. Both primary smelter production and primary refinery output for the years 1978 and 1979 declined from that of 1977. Mine production by Mount Isa Mines Ltd. (MIM) in Queensland, which supplies about 70% of Australia's output, increased in 1978 and 1979 from that of 1977. However, lower production was reported by Mount Lyell Mining & Railway Co. Ltd., in Tasmania, and Mount Morgan Ltd., in Queensland.

Lower output by both smelters and refineries was attributed to modernization of facilities, at which time operations were reduced and production declined. Production at MIM's refinery at Townsville, Queensland, was interrupted by the modernization of the tankhouse, the first part of which began operating in November 1978. The supply of concentrates to Electrolytic Refining and Smelting's refinery at Port Kembla, New South Wales, was reduced, and the smelter at Tennant Creek, Northern Territory, remained closed throughout 1978 and 1979.

At Mount Isa, the quantity of ore treated in 1978 was slightly above that of 1977. Copper ore production was mainly from the No. 1100 ore body in 1978 and 1979. An important feature was the increased recovery of ore from pillars left to maintain ground stability during initial mining. The success of the pillar recovery operations was attributed to the standing ability of the cement rock fill that was placed in previously mined areas. Approximately 40% of the copper ore extracted was from pillars in 1978, and 60% in 1979. The concentration on pillar mining in largely developed areas of the No. 1100 ore body resulted in a record level of productivity in the mine and the containment of mining costs. A new ore body (No. 1900) was ready for production at the end of 1979.

The Townsville copper refinery produced 139,950 tons of refined copper in 1978, compared with 139,140 in 1977. Output was marginally reduced in the latter half of the year to enable work associated with the $15 million tankhouse modernization program to proceed. Although from mid-1979 copper from Mount Isa was supplied as anode instead of blister, an anode-casting facility was still required at Townsville to enable anode scrap from the refining process to be melted.

Work at the new MIM Hilton Mine in 1978 and 1979 was confined to a continuation of the underground diamond drilling on the No. 10 level. The drilling completed so far indicates that the geological structure of the deposit was considerably more complicated than at Mount Isa. Primary ore reserves on June 30, 1979, were reported at 37 million tons containing 7.7% lead, 9.6% zinc, and 6 troy ounces of silver per ton.

Mount Lyell Mining & Railway Co. milled about 2.0 million tons of ore and produced 71,000 tons of copper concentrate at its Queenstown, Tasmania, plant in 1978. Ore output increased slightly over that of 1977, as production from the two principal sources, Prince Lyell and Cape Horn, increased. The company continued to operate at a loss and received financial assistance from Government sources. During 1978, Government subsidies to Mount Lyell totaled about $3.1 million.

Peko-Wallsend Ltd.'s copper operations at Tennant Creek, Northern Territory, remained closed throughout 1978 and 1979, but plans were being prepared for the recommissioning. The project was in a state of readiness and awaits firm indications of an improved trend in copper prices. One year would be required for recommissioning, as substantial changes were necessary to improve efficiency. However, 10,568 tons of copper concentrate was produced in 1978 and 15,478 in 1979, as a byproduct of mining gold-bismuth ore at Peko-Wallsend's Warrego Mine. The expanded gold ore treatment plant enabled a transfer of all milling and concentrate production to Warrego with consequently greater efficiency and lower cost per ton.

In 1978, Cobar Mines Pty. Ltd., in Cobar, New South Wales, owned by Broken Hill South Ltd. (BH South), treated 517,300 tons of copper ore (1977, 609,600 tons) to yield 29,000 tons of copper concentrate assaying 28.3% copper. The decrease in ore extracted in 1978 compared with 1977 was largely owing to delays in bringing a new open stope into production because of geological conditions that adversely influenced drilling and blasting. The average grade of copper ore treated was 1.7% copper, compared with 1.2% for 1977. The increased metallurgical recovery of copper from the previous year reflected the higher ore grade. The copper concentrate produced in 1978 and 1979, continued to be sold to Electrolytic Refining and Smelting Co.

Kanmantoo Mines Ltd., in Kanmantoo, South Australia, managed by BH South, remained closed throughout 1978 and 1979. Facilities have been maintained on a care-and-maintenance basis since its closure in 1976. Revenue from hire charges on equipment partly offset the cash costs of maintaining the mine site and facilities.

Although several old mines could be reopened in the early 1980's, the most significant copper production may involve new developments, in particular the Olympic Dam project in South Australia and the Benambra deposit in Victoria. Western Mining Corp. (WMC) continued diamond drilling at the Olympic Dam project near Roxby Downs, where about 10 vertical holes intersected an extensive zone of copper and uranium mineralization at about 350 meters below the surface, varying between 10 and 250 meters in thickness and with grades generally between 1.0% and 2.5% copper. The holes were spaced over an area of 1,500 meters by 400 meters. Also, a joint exploration venture by WMC-BP Australia Pty. Ltd. continued work on the massive copper-silver-lead-zinc deposit located near Benambra. The Benambra drill hole assays 3.2% copper, 6.8% lead, 6.5% zinc, and 150 grams of silver per ton. Considerably more drilling will be needed to determine whether the mineralization is part of an economic ore body or merely an isolated lens. If the discovery reaches the development stage, WMC will hold a 51% interest in the Benambra joint venture and BP Australia Pty. Ltd. the remainder.

Output of the principal copper producers in recent years is summarized in the following tabulation:

Table 4.—Australia: Major copper production, by company

(Metric tons)

Facility	Production[1]		
	1977	1978	1979
Mines:			
Mount Isa Mines Ltd	155,945	159,064	160,500
Mount Morgan Ltd	5,586	4,399	5,200
Cobar Mines Pty. Ltd	5,640	8,153	8,100
Mount Lyell Mining & Railway Co. Ltd	20,394	18,444	18,500
Electrolytic Zinc Co. of Australia Ltd. (EZ Co.)	1,625	1,585	1,625
Peko-Wallsend Ltd	4,443	3,334	3,475
Smelters:[2]			
Mount Isa Mines Ltd	139,110	147,430	152,400
Mount Morgan Ltd	5,420	4,920	5,800
Electrolytic Refining and Smelting Co. of Australia Ltd[3]	14,898	15,721	17,100
Refineries:[4]			
Mount Isa Mines Ltd	139,143	139,948	141,800
Electrolytic Refining and Smelting Co. of Australia Ltd[3]	13,681	13,221	13,140

[1] Metal content of ore.
[2] Primary blister copper.
[3] Treats concentrates from Cobar.
[4] Primary electrolytic copper.

Gold.—The Australian gold industry improved dramatically during 1978 and 1979 in response to higher metal prices. As a result of the price increases, many companies began reexamining prospects, reopening mines that had closed when operations became uneconomic, and searching for new gold-bearing areas. The announcement by the Treasurer in the Budget speech that the tax exempt income on gold production would continue, was also of considerable assistance to Australia's gold producers.

The Telfer Mine in the Paterson Range in Western Australia operated throughout 1978 and 1979. The open pit project owned by Newmont Pyt. Ltd. and BHP, mined about 4.5 million tons of ore, averaging 0.28 troy ounce of gold per ton in 1979. The ore was completely oxidized, and the gold occurred as descrete particles of varying sizes but mostly as fine grain. The ore was partially free milling, and up to 40% of the gold was recoverable by a gravity process. The remainder was recovered by conventional cyanide leaching. The Telfer ranks as one of the most important gold producers in Australia.

Kalgoorlie Mining Associates (Kalgoorlie Lake View Pty. Ltd.-Homestake Gold Ltd.) continued to operate the Mount Charlotte Mine at Kalgoorlie. The company began a rehabilitation program involving repairs and additions to the treatment plant at Fimiston and the installation of a crushing section. Kalgoorlie Mining Associates expects to reduce the cost of producing gold by about $10 per ounce when the program is completed.

Central Norseman Gold Corp. Ltd., near Kalgoorlie, remained Australia's largest gold producer. The company produced approximately 123,000 troy ounces in 1979. Development work continued on the No. 4 and No. 5 levels of the North Royal Mine, which was the main source of the gold produced. The company was also producing gold from an open pit operation near the surface. Central Norseman encountered encouraging diamond-drill intersections in the program to extend its ore reserves at the mine. Ore reserves were estimated at 350,000 tons averaging 0.53 troy ounce of gold per ton in 1979.

The Warrego Mine (formerly a copper

mine), operated by Peko-Wallsend Ltd., was the only producing gold mine at Tennant Creek. The Warrego copper concentrator was modified to treat Warrego gold ore. During the year, 202,500 tons of gold ore was treated assaying 0.58 troy ounce per ton, with gold recoveries of 91.60%. This ore yielded 81,100 troy ounces of gold bullion in 1978. In 1979, the company treated 248,142 tons of ore yielding 108,906 troy ounces of gold.

Wattle Gully Gold Mines NL plans to reopen its Chewton gold mine near Castlemaine, Victoria. The company, which has been treating tailings at the mine for the past 12 months, has applied to the Victorian Department of Minerals and Energy for permission to reopen. When the mine closed it was treating 200 tons of ore per week and producing grades of over 1 troy ounce per ton.

Production of refined gold from all sources was some 650,000 troy ounces in 1979. Newly won gold of domestic origin accounted for 77% of the total, and refined gold produced from imported crude bullion and domestic and imported scrap accounted for the remainder. The Perth Mint, which refines crude gold bullion from gold mines in Western Australia and the Northern Territory, as well as some bullion and scrap of overseas origin, was the largest domestic refinery of gold. Other gold refiners were Matthey Garrett Ltd. in Sydney and Engelhard Industries Ltd. in Melbourne. Most of the crude bullion from Fiji and Papua New Guinea was refined by Matthey Garrett. Base metal refineries were the only other source of refined gold. In 1979, the Electrolytic Refining and Smelting Co. recovered some 11,200 troy ounces of gold from tankhouse sludges resulting from the electrolytic refining of copper at Port Kembla, and Broken Hill Associated Smelters Pty. Ltd. recovered about 6,400 troy ounces from lead concentrates refined at Port Pirie, South Australia.

The principal gold producers and quantities recovered during 1978 and 1979 were as follows:

Table 5.—Australia: Major gold production, by company

(Troy ounces)

Company	Production	
	1978	1979
Central Norseman Gold Corporation NL	120,000	123,000
Kalgoorlie Lake View Pty. Ltd	102,600	105,000
Newmont Pty. Ltd	141,000	130,000
Peko-Wallsend Ltd	134,590	136,600

Iron and Steel.—Domestic production of iron ore decreased in 1978, compared with 1977, reflecting reduced world demand and considerable accumulation of stocks by both producers and consumers. Production in 1979 returned to the 1977 level but was below the record output of 1975. Demand for steel also remained depressed in both 1978 and 1979, but a slight improvement was reported in the domestic market. The continuing recession in the Japanese steel industry affected the demand for raw materials, and Australian producers of iron ore experienced difficulty in obtaining contracts. Negotiations between Australian producers and Japanese consumers over prices in some contracts were not concluded. However, European prices for 1978 and 1979 shipments on a c.i.f. basis were reported to have been fixed at between 10% and 16% below those of 1977.

As in recent years, most of the iron ore was produced in the Pilbara region in northwest Western Australia. In this area, five major companies produced about 90% of Australia's total iron ore output: Hamersley Iron Pty. Ltd. (Mount Tom Price and Paraburdoo), Mount Newman Iron Ore Pty. Ltd. (Whaleback Hill), Cliffs Western Australian Mining Co. Pty. Ltd. (Robe River), Goldsworthy Mining Ltd. (Mount Goldsworthy, Shay Gap, Sunrise Hill), and Dampier Mining Co. Ltd. (Kooian Island and Yampi Sound). In addition to the Pilbara region, iron ore was mined at Kollyanobbing by Dampier for use in the Kwinana blast furnace. In South Australia, Broken Hill Pty. Ltd. Co. (BHP) produced ore from the Middleback Ranges for steel plants in South Australia (Whyalla) and in New South Wales (Newcastle and Port Kembla). In a relatively small project, the iron ore at Savage River, Tasmania, was slurried and pumped to a pelletizing plant at Port Latta for shipment to Japan.

Production of iron ore by Hammersley in 1978 decreased some 17% from that of 1977. The decline was attributed to a drop in demand by Japanese steel producers and increased industrial disruption during 1978.

Again in 1979, operations at Hamersley's mines and Dampier port and processing facilities were suspended for several weeks as a result of strike action by eight unions over a series of workers' claims. Recovery of saleable ore from material mined at Mount Tom Price declined from 59% to 50% during 1978. Salable ore production at Mount Tom Price was 16 million tons compared with 21 million tons in 1977. Production consisted of 8.3 million tons of high-grade lump, 7.4 million tons of high-grade fines, and 400,000 tons of low-grade fines. Salable ore production at Paraburdoo in 1978 was 13.2 million tons compared with 13.7 million in 1977. Production consisted of 6.1 million tons of high-grade lump and 7.1 million tons of high-grade fines. Material mined totaled 26.4 million tons. Total material movement in the mine was 32.9 million tons in 1978. Progress was made during the lower levels of production to increase the proportion of Paraburdoo ore in total production from the 39% obtained in 1977 to 45% in 1978. This would extend the life of the Mount Tom Price ore body, which was less than the expected life for Paraburdoo. Also, Hamersley spent $350 million on a project in 1978 and 1979 to expand the beneficiation plant, which upgrades low-grade ore (about 59% Fe) to marketable high-grade ore (about 64% Fe). Production capacity was increased by 6 million tons per year to 46 million in late 1979.

Production in 1978 and 1979 by Mount Newman Consortium, a joint venture operated by Mount Newman Mining Co. Pty. Ltd., remained at about the same level as that of 1977. Sales for 1978 totaled 32 million tons and quantity of ore in the stockpile totaled 2 million tons. Mount Newman was constructing a heavy-media beneficiation plant which was completed in mid-1979. Total cost of the plant and associated infrastructure was about $100 million. The plant recovers ore from contaminated waste material and provides Mount Newman with greater flexibility to increase capacity at a later date.

Goldsworthy Mining Ltd. produced 3 million tons of iron ore in 1978, 50% less than that of 1977. Production in 1979 dropped to approximately 1.3 million tons. Production came from the company's mines at Shay Gap and Sunrise Hill, which are located 113 kilometers and 180 kilometers, respectively, east of Port Hedland in Western Australia. Goldsworthy plans to cease production in the Pilbara area by mid-1981. With no contract for its 700 million tons of Area C iron ore, Pilbara's Goldsworthy project will stop when its existing ore reserves and contracts run out. The company had only 13.3 million tons of iron ore reserves and contracted to supply 5.5 million tons annually for the next 2 years.

The principal Australian iron ore producers and their output in 1978 and 1979 were as follows, in thousand tons:

Table 6.—Australia: Major iron ore production, by company

Company	Location	Products	Output	
			1978	1979
Hammersley Iron Pty. Ltd	Western Australia	Lump and pellets	29,445	33,000
Mount Newman Mining Co. Pty. Ltd	do	Lump	29,160	35,000
Broken Hill Pty. Co. Ltd	South Australia	Lump and pellets	3,319	4,000
Do	Western Australia	Lump	1,684	2,000
Goldsworthy Mining Ltd	do	do	3,000	1,500

Australian reserves of iron ore were estimated at 35 billion tons, consisting of 25 billion tons of hematite, with 54% or more iron content, and 10 billion tons of limonite, with 50% or more iron content. Most of Australia's reserves occur in the Pilbara region, which accounted for over 90% of production in 1979. New mines in the region, however, are unlikely unless iron ore prices rise substantially, since none of the three planned projects was economically viable at present prices. The Japanese steel industry will not negotiate any contracts with new Western Australia iron ore companies until the early 1980's.

The BHP Co. remained the only steel-producer in Australia, with plants at Newcastle and Port Kembla in New South Wales, Whyalla in South Australia, and Kwinana in Western Australia. Production of raw steel in 1978 totaled 7.4 million tons compared with 7.5 million tons in 1977. Shipments of 3.7 million tons of steel to the domestic market in 1978 was slightly above that of 1977. Total capacity was about 9 million tons per year. Despite idle capacity, the company was expanding capacity to follow estimated future market requirements. Major work completed in 1978 at Newcastle included the No. 5 ore unloader. Projects still in progress in 1979 included the No. 5 coke ovens battery and modifications to the coal cleaning plant and steelmaking shop. At Port Kembla, work on the continuous slab caster with vacuum degasser, and modifications to the No. 5 blast furnace were in progress during 1979. These installations represent large investments in the steel industry and in each case provide the benefits of the latest technology, which should result in quality improvements. Work was also continuing on modifications of the basic oxygen steel making plant. At Whyalla, work was continuing on the construction of the coke ovens extensions, and relining of the No. 1 blast furnace was completed in 1979. Installation of the coil plate processing line adjacent to the new hot-strip mill of John Lysaght (Australia) Ltd. was continuing at Westernport, Victoria.

Conzinc Riotinto of Australia and Korf Stahl AG of West Germany were studying the feasibility of establishing a 200,000-ton steel mill at Geelong, Victoria. The mill would have two electric furnaces and use scrap metal as raw material.

Lead and Zinc.—In 1978, mine production of lead decreased from the 1977 level. Increased production at Broken Hill and the startup of the Woodlawn Mine were offset by declining output at Mount Isa owing to the mining of lower grade ores. In 1979, however, a further increase in output from the new Woodlawn Mine, an increase in production at Mount Isa, and recovery to a more normal level of output from mines at Broken Hill resulted in higher output for both lead and zinc. The sole domestic producer of primary refined lead, Broken Hill Associated Smelters (BHAS) at Port Pirie, operated at full capacity throughout the second half of the year, and primary production increased by 12%.

Mine production of zinc rose significantly in 1979, compared with that of the previous 2 years. Output by two Broken Hill mines and new production at Woodlawn more than offset lower output at the North Broken Hill Mine, where damages and industrial disputes led to a substantial decline in production. Output of primary refined zinc at all three refineries in 1978 and 1979 was higher than that of 1977. Contrary to worldwide trends, exports of refined zinc increased substantially as a result of increased sales in the South East Asian market.

MIM was Australia's largest single producer of lead and zinc. About 2.3 million tons of lead-zinc ore was mined in 1978 containing 6.4% lead and 6.5% zinc. Mining was concentrated between the 13 level (670 meters) and 15 level (730 meters). The Mount Isa mining methods of cut and fill and open stoping were modified to achieve greater ore recovery and better utilization of workers and equipment.

A major development in 1978 at Mount Isa was the completion of the 270-meter lead smelter stack, which would greatly reduce the need for curtailments and shutdowns to maintain air quality. Drilling of the lead-zinc mineralized area continued in the northern part of the Mount Isa Mine throughout 1979 and some drilling was done in the footwall region. The drilling in the latter area was quite deep, about 1,100 meters below the surface. As a result of the drilling, over 1 million tons of ore was added to the zinc and lead reserves.

Exploration and study of the McArthur River zinc-lead deposit in the Northern Territory by MIM continued. The work involved the operation of a 50-ton-per-day pilot plant and support facilities. The pilot plant results were being used in a major overall feasibility study, of which the pilot plant operation was a part. Also, geological and metallurgical investigations related to McArthur mineralization continued. Seventy people were employed at the site.

In 1979, mine output by Australian Mining and Smelting Ltd.'s (AM&S) two subsidiaries, Zinc Corp. Ltd. and New Broken Hill Consolidated Ltd. (NBHC), increased from the levels of 1977 and 1978. In 1978, lower output was attributed to labor problems, which resulted in two work stoppages. One, which lasted 8 days, was confined to a small group of tradespersons, and production continued on a reduced basis throughout the strike. The second involved a complete loss of production for 2 days. The NBHC haulage shaft was unavailable for 9 operating days in the second quarter following a mishap. These factors, coupled with the lower overall grades of ore mined in 1978, resulted in lower lead and zinc concentrate production. Both mines operated throughout 1979 without work stoppages.

A consortium, consisting of Conzinc Riotinto of Australia, St. Joe Minerals Corp., and Phelps Dodge Corp. of the United States, formally inaugurated the Woodlawn Mine project in December 1978. Following a commissioning period, the open pit mine, located at Woodlawn, New South Wales, attained planned production levels of copper, zinc, and lead concentrates in early 1979. When operating at capacity, the mill would produce about 120,000 tons of zinc concentrates, 40,000 tons of lead concentrates, and 35,000 tons of copper concentrates annually. Output would be divided among the three joint venture partners, each of which would arrange its own sales. Diamond drilling in 1979 revealed ore reserves of 10 million tons, averaging 12% zinc, 4.5% lead, 1.8% copper, and 1.8 troy ounces of silver per ton.

The BHAS lead plant operated at near capacity for most of 1978 and 1979, with increased lead output each year. The company continues to pursue new development programs and a Linde air separation plant was commissioned in June 1978 to supply oxygen to the blast furnaces. Acid plant modifications and extensions were completed in early 1979. Also, work commenced in 1979 on the extensions to the lead refinery and construction of a Kroll-Betterton debismuthizing plant for producing low-bismuth lead. The No. 2 blast furnace began operating in August 1978, and the use of oxygen in the furnace resulted in a significant increase in lead production. The company, in conjunction with the Commonwealth Scientific Industrial Research Organization (CSIRO), was also examining a reflux refining process for lead. Construction of a 1-ton-per-hour pilot plant was completed, which includes a reflux column, crystallizing chamber, and a process control computer.

EZ Industries Ltd. operated three mines, Rosebery, Hercules, and Farrell, all in Tasmania. The Rosebery and Hercules are zinc-lead-copper deposits in association with gold, silver, and pyrite. The Farrell Mine is a silver, lead, and zinc vein deposit. The combined output of ore mined totaled some 610,000 tons in 1978, slightly more than that in 1977. The Rosebery Mine, where substantial improvements were made in 1977, was the main reason for the rise in production. The average grade of ore production from all mines was 12.3% zinc, 3.8% lead, and 5 troy ounces of silver per ton. Products of the concentrating mill were zinc, lead, copper, silver, gold, and pyrite concentrates, which were railed to the port of Burnie. There were 11 line-haul locomotives and 69 bulk wagons of 44-ton capacity on the railway. Traffic on the line exceeded 600,000 tons per year.

The principal lead and zinc companies and quantities produced during 1978 were as follows:

Table 7.—Australia: Lead-zinc production, by company

(Metric tons)

Mine	1977		1978		1979	
	Lead	Zinc	Lead	Zinc	Lead	Zinc
North Broken Hill Ltd	52,877	39,442	51,080	38,685	52,000	39,400
Zinc Corporation Ltd	86,240	56,700	79,400	61,000	80,000	63,000
New Broken Hill Consolidated Ltd	78,240	137,200	61,600	121,000	64,000	127,000
Mount Isa Mines Ltd	131,390	101,027	127,600	105,540	130,000	109,000
Electrolytic Zinc Co. of Australasia Ltd. (Read-Rosebery)	20,459	70,341	21,500	70,850	22,300	69,700

Manganese Ore.—Domestic production of manganese ore in 1978 and again in 1979 was less than that for 1977, in line with decreased steel output. Consumer stocks of manganese ore also rose substantially during both 1978 and 1979. More than 90% of the output was supplied by the Groote Eylandt Mining Co. Pty. Ltd. (GEMCO), a subsidiary of BHP.

GEMCO shipped 1.2 million tons of manganese ore from its operations in the Northern Territory in 1978. The largest tonnage (600,000 tons) went to Japan. About 230,000 tons was shipped to Europe, 110,000 tons to the United States, and 40,000 tons to the Republic of Korea. The remaining 220,000 tons was domestically consumed and processed by the Bell Bay plant, operated by Tasmanian Electro Metallurgical Co. Pty. Ltd. (TEMCO), a subsidiary of BHP. The plant produced some 103,000 tons of ferroalloys. Although this was 8% higher than last year, it was well below plant capacity owing to limited demand. Approximately 25,000 tons of ferroalloys was exported in 1978, compared with 37,000 tons in 1977. About 1.3 million tons of manganese ore was shipped in 1979, mostly to Japan, Europe, the United States, and the Republic of Korea.

Most ore for export was sold on a contract basis, and prices are negotiated annually between buyer and seller. Prices of high-grade lump ore from Groote Eylandt remained at $65.28 per ton f.o.b. during 1978 and 1979. Low-grade ore reportedly remained at the $1.28 per ton unit of contained manganese f.o.b. quoted for 1977.

Australian manganese reserves were estimated at about 889 million tons in 1979, the main part of which was on Groote Eylandt. The remainder was located principally in the east Pilbara and Peak Hill regions of Western Australia and at Pernatty Lagoon in South Australia. Known deposits in the Northern Territory were subeconomic. Large secondary enrichment deposits along the outcrop of the Marra Mamba iron formation in the Pilbara were being evaluated. These deposits were low in silica and consisted of about equal proportions of high-grade ore (40% manganese) and lower grade ores suitable for beneficiation.

Nickel.—The international market for nickel was seriously affected by a buildup of stock and instability of prices in 1978 and 1979, which led to some adjustments in the pattern of production in Australia. Although Australia remained the world's fourth largest producer of nickel, production declined significantly in both 1978 and 1979. Output from the new $100 million Agnew mine was not sufficient to offset the loss resulting from the closure of the Redross and Windarra mines in 1978. Sulfide-based mines in Western Australia accounted for 60% of total production, with the remainder coming from the Greenvale lateritic mine in Queensland.

At the end of 1979, the Kambalda Mine at Kalgoorlie was still the principal nickel producer, accounting for more than 50% of the Australian production. The Greenvale operation in Queensland was the next largest. The Nepian, Spargoville, and Agnew mines in Western Australia together produced less than 10% of the Australian total. Suspension of mining at Windarra and Redross during 1978 represented a loss of about 11,000 tons of nickel annually. It was announced that the Spargoville Mine would close in early 1980 unless there is a sustained upturn in market conditions.

In 1978, WMC treated 1.4 million tons of ore and produced 316,800 tons of concentrate containing 37,332 tons of nickel. Sources of nickel concentrate during the year were mining operations at Kambalda, Windarra, Scotia, and Carr Boyd. In February 1978, production from the open pit mine at South Windarra was suspended, and underground production at Mount Windarra ceased in June. At the beginning of 1979, WMC had seven production shafts and declines in operation. Deepening of four declines and several shaft sinkings continued throughout 1979. Declines were advanced on the Jan, Hunt, Ken, and Gellatly shoots. Jan shaft was completed to a depth of 620 meters, and underground development continued. Sinking of Long shaft continued to a depth of 863 meters. Work on Victor shaft was suspended in 1979. Total development, including raise drilling, during 1978 and 1979 was 25,000 meters.

In addition to operating the Kambalda and Scotia mines and managing the Windarra Mine, in which it has 50% interest, WMC owned the smelter at Kalgoorlie and the refinery at Kwinana. The company treated ore and concentrates from other mines on a toll basis and also smelted the half of Windarra production owned by the Shell Co. of Australia Ltd. Throughput for 1978 of 304,000 tons of concentrate was the highest to date. Expansion of the smelter capacity to 450,000 tons annually (concentrate) was completed in early 1979.

Construction of the Agnew nickel project, which was a joint venture of Western Selcast Pty. Ltd. and MIM Holding Ltd., was completed in June 1978. The plant, located near Leinster, Western Australia, was expected to produce 10,000 tons of nickel in concentrate annually. The concentrator commenced treatment of development ore in May 1979. The plant operated at reduced capacity until general stope production in the mine began in the first quarter of 1979. Production at capacity level was achieved during the fourth quarter of 1979. Sinking of the shaft to explore the major No. 2 ore body reached 221 meters below the surface by June 30. The total planned depth was 910 meters. The project contains a minimum of 46 million tons of sulfide ore averaging 2% nickel.

The Greenvale Mine in Queensland, owned equally by Metals Exploration Ltd. and Freeport of Australia Inc., was operated at about 70% of designed capacity during 1978 and 1979. The operation, which treats (acid leach) lateritic ore, has overcome most of the early technical problems, but serious financial difficulties persist. Operations have generated a positive cashflow, but this has been totally inadequate to meet the cost of servicing the development loans. Some relief was obtained when the financiers agreed to a deferment of interest payments, but the financial viability of the whole project remains in doubt.

Some exploration work for nickel was in progress, mainly in Western Australia. At Forrestania, Western Australia, Endeavor Oil Company N.L. continued exploration at its Digger Rocks prospect. Also, Anglo American, Australian Aquitaine Petroleum Pty. Ltd., BHP, and Kennecott Copper Corp. continued exploring in the Kimberley Range of Western Australia.

Silver.—Most silver was produced as a byproduct of lead-zinc mining with gold and gold-copper mining making a contribution. Total silver production in 1979 was slightly above the 1978 output but below that for 1977. More than 85% of the output came from mines in Mount Isa, and Broken Hill. Silver was also produced as a byproduct of copper mining at Tennant Creek, Mount Morgan, Cobar, Woodlawn, and Mount Lyell.

MIM remained Australia's largest producer of silver. In 1978, about 2.3 million tons of lead-zinc ore, averaging 6.9 troy ounces of silver per ton, was treated to produce 10.3 million troy ounces of silver in concentrates. Mount Isa's output increased slightly to 10.4 million troy ounces in 1979. About 87% of the silver was recovered from lead concentrates and the remainder from zinc and copper concentrates. The lead concentrates were smelted to lead bullion at Mount Isa and exported to the company's lead refinery at Northfleet, United Kingdom, where the silver metal was recovered. Over 70% of the zinc concentrate was exported; the remaining 25% was shipped to the zinc refinery at Risdon, Tasmania. Silver in copper and lead residues from the electrolytic tankhouse slimes from the Townsville copper refinery were either recovered by Electrolytic Refining and Smelting Co. or exported.

The Broken Hill area remained Australia's second largest source of silver in 1978 and 1979. Production of silver from the lead-zinc concentrates in 1978 by several companies declined because of strikes, the need for plant repairs, and a lower overall grade of ore mined. With the absence of strikes in the lead-zinc industry during 1979, output of silver advanced. More ore was mined from the zinc-rich lodes, which contained about 3 troy ounces of silver per ton, compared with 7 troy ounces per ton in the lead-rich ore bodies. Most of the silver produced at Broken Hill was contained in lead concentrates which were treated at the BHAS's smelting and refining plant at Port Pirie.

At Mount Morgan, Queensland, silver was recovered in blister copper produced from open pit copper-gold ore. In 1978, production totaled 35,123 troy ounces, to which the Warrego Mine at Tennant Creek contributed 12,210 troy ounces.

EZ Co. produced silver as a byproduct of copper-lead-zinc mining at Rosebery. In 1978, the company treated about 550,000 tons of Rosebery ore, 66,000 tons of Hercules ore, and 13,500 tons of dump material. The average silver grade of the complex copper-lead-silver-gold ore treated was 4 troy ounces per ton, the same as the grade in 1977. The ore yielded 132,000 tons of zinc concentrate containing 481,000 troy ounces of silver, 14,000 tons of lead concentrate containing 400,000 troy ounces of silver, and 27,000 tons of copper concentrate containing 1.6 million troy ounces of silver.

Silver produced by EZ Co. has been stable in recent years, and output in 1979 was virtually the same as that in previous years. Lead and copper concentrates were exported, and the silver in the zinc concentrate, which was treated at the Risdon refinery, was recovered in copper-lead-zinc residues.

About 80% of all silver exported in 1978 and 1979 was contained in lead bullion, lead, zinc, and copper concentrates, blister copper, and various slags, mattes, and residues. The remainder was exported as refined silver and mint bullion.

Principal producers of silver and output, in thousand troy ounces, during 1977, 1978, and 1979, were as follows:

Table 8.—Australia: Major silver production, by company

Company	1977	1978	1979
Electrolytic Zinc Co. of Australasia Ltd	2,466	2,481	2,470
Mount Isa Mines Ltd	10,434	10,283	10,400
New Broken Hill Consolidated Ltd	1,820	2,163	2,200
North Broken Hill Ltd	2,700	2,168	2,400
Zinc Corporation Ltd	1,740	1,155	1,300

Tin.—Decontrol of the tin market in 1976 by the International Tin Council resulted in a rapid escalation of prices that existed throughout 1978 and 1979. These conditions encouraged the Abminico NL group (Aberfoyle Tin NL, Cleveland Tin NL, and Ardlethan Tin NL mines) and Renison Ltd. to significantly increase production in 1978 and 1979. Although the continuing strength of world tin prices in 1978 and 1979 brought prosperity to Australian tin miners, the Australian Tin Producers' Association (ATPA) expressed concern that high prices and shortage of supplies could encourage technical developments to reduce the use of tin. ATPA indicated that an immediate solution would be the release of tin from the U.S. stockpile. The Association stated that shortages must be met for tin prices to remain at a level at which large-scale substitution would not occur.

Renison Ltd., located in Renison, Tasmania, was Australia's principal tin producer and remained the world's largest tin producer from a hard-rock underground mining operation. Ore produced from Renison's mining operations in 1978 increased 9% to 597,700 tons compared with that of 1977. The concentrator operations were satisfactory throughout the year. Ore throughput was increased by 35,400 tons (6%), and tin in concentrate was 580 tons (12%) higher than in the previous year. The leaching plant, commissioned in late 1977 to treat acid-soluable gangue minerals from low-grade flotation concentrate, also operated throughout 1978 and 1979. The commissioning of the leaching plant permitted the closure of the Vanner section of the gravity plant, and tin formerly recovered in that section was recovered by flotation. Renison announced plans in 1979 to spend $22 million on a major mine expansion program. Mine production would be increased 42% from 600,000 to 850,000 tons annually. Work began in March 1979 and would be finished by the end of 1980. The production increase would precede construction of a smelter to handle ore from the Bell Hill Mine in northwestern Tasmania. Australia had one tin smelter in 1979, which was operated at Alexandria, New South Wales, by Associated Tin Smelters Pty. Ltd. (ATS). The Renison Mine provided over 50% of the plant's raw material. Renison recently renegotiated a new contract with ATS that would expire at the end of the production expansion phase. Renison's combined proved and probable reserves increased 15% to over 1.2 billion tons in 1979, but the grade dropped from 1.19% tin to 1.14% tin. The increase in tonnage and reduction in grade was largely a result of the addition of 2.1 million tons of ore averaging 1.06% tin added to reserves during 1979.

The Abminico NL group increased production approximately 15% compared with that of 1977, but performance of individual mines varied. The Ardlethan Mine, in New South Wales, produced 1,715 tons of concentrate in 1978, up from 1,110 tons in 1977. Output by Cleveland Mine, at Luina, Tasmania, dropped to 1,238 tons from 1,386 tons in 1977, and output at the Aberfoyle and Storeys Creek mines dropped from 120 tons to 107 tons in 1978.

The Cleveland Mine continued to suffer throughout 1978 and 1979, as it did in the last half of 1977, from excessive wallrock dilution and multiple faulting. Tin metal in concentrates produced in 1979 was 11% lower than in 1977. Mill throughput in 1979 was also marginally lower, but metal recoveries improved significantly. The Ardlethan Mine improvement began in the last half of 1977, and continued throughout 1978 and 1979. Production of tin in concentrates increased by 54% in 1978 over the 1977 level. Head grade and metallurgical recovery were both significantly improved over the previous year's figures. The Aberfoyle and Storeys Creek mining operations in 1978 and 1979 continued to be heavily dependent on the extraction of remnant ore blocks at both mines. Mill throughput at 36,600 tons in 1978 was 10% lower than in 1977 owing to limited availability of ore and a 3-week industrial stoppage.

ATS, operating at Alexandria, New South Wales, was the only domestic producer of primary refined tin. Production in 1978 was 5,129 tons, about 6% less than in 1977. The smelter is a joint venture of O. T. Lempriere and Co. Ltd. and Australian Iron and Steel Pty. Ltd. Production capacity of the smelter was originally rated at 15,000 tons annually of concentrates, equivalent to about 10,000 tons of tin metal per year, but the low average grade of concentrates available to the smelter reduced its effective capacity to about 7,000 tons per year.

Titanium and Zirconium.—In 1978 and 1979, the world market for mineral sands concentrates was generally weak, prices low, and production erratic. Ilmenite production increased slightly in 1978 but declined in 1979. Production of rutile rose in 1978 and 1979, but zirconium declined in 1978 and rose in 1979. Demand for rare-earth oxides in the United States and Europe enabled the upward trend in monazite concentrates production to continue in 1978 and 1979. Virtually all the rutile, zircon, and monazite output was exported, along with about 50% of the ilmenite. The remainder of ilmenite was consumed within Australia for the production of titanium dioxide pigments and for the production of synthetic rutile. The principal destinations for the products were Western Europe, Japan, and the United States.

Australia produces over 90% of the world's natural rutile, about 80% of the zircon, 70% of the monazite, and over 25% of the world's ilmenite. The industry was divided, generally, into three groups, the east coast producers of rutile and zircon, the west coast producers of ilmenite and zircon, and the new west coast producer of rutile, zircon, and ilmenite. On the east coast, four main groups (Associated Minerals Consolidated Ltd., Consolidated Rutile Ltd., Mineral Deposits Ltd., and Rutile & Zircon Mines Ltd.) accounted for most of the output. In 1978, Associated Minerals Consolidated Ltd. produced about 100,000 tons of rutile and 80,000 tons of zircon from plants in New South Wales and Queensland. Consolidate Rutile Ltd. produced approximately 25,000 tons of rutile in 1978 but has expanded plant facilities and expects to produce about 60,000 tons of rutile and 45,000 tons of zircon in 1979. Production by Mineral Deposits Ltd. totaled roughly 45,000 tons each for both rutile and zircon. Combined production by two plants operated by Rutile & Zircon Mines Ltd. totaled 58,000 tons of zircon and 45,000 tons of rutile in 1978.

On the west coast, five producers (Western Titanium Ltd., Allied Eneabba Pty. Ltd., Jennings Mining Ltd., Westralian Sands Ltd., and Cable Sands Ltd.) supplied most of the output of mineral sands in 1978 and 1979. Westralian Sands produced approximately 350,000 tons of sulfide-grade ilmenite. The other main products were 40,000 tons of zircon, 15,000 tons of leucoxene, and 3,000 tons of monazite. Cable Sands output consisted of 140,000 tons of ilmenite, 5,000 tons of leucoxene, 16,000 tons of zircon, and around 1,000 tons of monazite. Small quantities of xenotime and garnet were also produced. Western Titanium Ltd.'s main product continued to be ilmenite. Production totaled about 250,000 tons in 1978. Other products included 25,000 tons of zircon, 5,000 tons of leucoxene, and about 1,000 tons of monazite. At Allied Eneabba Pty. Ltd., ilmenite, zircon, and rutile, totaling 250,000 tons, 120,000 tons, and 50,000 tons, respectively, was produced. Production at Jennings was reduced considerably to suit the difficult market conditions. The company's yearly output for 1978 and 1979 totaled about 10,000 tons of rutile, 10,000 tons of zircon, and 45,000 tons of ilmenite.

One reason for the involvement of so few companies in Australia's mineral sands operations was attributed to the declining grade of ore reserves. The high-grade deposits have been mined out, and the mining companies have moved toward lower grade reserves, which require larger and more expensive processing facilities. Also, large areas containing known reserves of rutile and zircon have been precluded from mining by their being incorporated into new national parks. Australia's Bureau of Mineral Resources estimates that over 40% of identifiable economic resources of zircon and rutile on the east coast was unavailable for mining because of environmental considerations.

At yearend 1979, proven and probable reserves of heavy mineral sands totaled about 68 million tons in western Australia, 20 million tons in Queensland, and 20 million tons in New South Wales. The content of heavy minerals ranged from 1% near Newcastle, New South Wales, to 80% at Eneabba, Western Australia. Most producers continued exploration in 1978 and 1979, and most of the activity was in Western Australia.

NONMETALS

Phosphate Rock.—Australia's first company to produce and export phosphate rock ceased operations in June 1978. The decision by BH South Ltd. to close down the operation of its subsidiary, Queensland Phosphate Ltd. at Duchess, came after both the Australian Government and the Queensland State government refused financial assistance to the company. When Duchess came into production in 1975, it was unable to establish long-term export sales contracts so essential to its economic viability and consistently operated well below its design capacity of 2 million tons annually. The country most likely to benefit most from the mine closure is Nauru, the dominant supplier to the Australian market. The Australian fertilizer industry consumes about 2.4 million tons of phosphate rock annually.

Domestically, Queensland Phosphate had to compete with rock imported from British Phosphate Commission's operations in Nauru, Banaba, and Christmas Islands. Characteristics of rock from these three different sources were different, and require slightly different processing methods. The Queensland Phosphate rock had a high silica content, was difficult to grind, and caused adverse chemical reactions in domestic manufacturing plants. The Australian fertilizer manufacturers were unwilling to undertake the necessary capital expenditure in changing from their established source of supply to the Queensland material.

In 1978, Queensland Phosphate produced 250,000 tons of phosphate rock averaging 32.17% P_2O_5. Production came mainly from the southern area where thicker sections of direct-shipping-grade rock gave a more favorable waste-to-ore ratio. A heavier than usual rainfall during the wet season caused a reduction in mine output in January. Haul road washouts and local flooding occurred, but pit flood protection systems prevented runoff water from entering the pits. The performance of the treatment plant steadily improved as operating techniques were refined and minor technical improvements were made. The Townsville facilities processed about 252,000 tons of phosphate rock through the dryer. Shipments during the year totaled roughly 275,000 tons. A total of 200,000 tons was taken by south and east Asian markets, and 60,000 tons was shipped to Australian ports. The major share of export sales was to Japan, Korea, and Malaysia, and deliveries will be made from stockpiles to those markets in 1979. Sales to Australia were mainly for production testing purposes.

A small quantity of phosphate rock, an estimated 11,000 tons in 1978 and 1979, was produced in South Australia. The material was not suitable for superphosphate manufacture because of its high iron and aluminum content and was used directly as fertilizer.

Salt.—In 1978 and 1979, both production and export of salt decreased owing to depressed demand resulting from the downturn in world economy. Five major companies, Texada Mines Ltd., Dampier Salt Ltd., Leslie Salt Co., Lefroy Salt Pty. Ltd., and Shark Bay Salt Pty. Ltd. (all based in Western Australia) produced about 80% of the total domestic output. Producers in South Australia, Victoria, and Queensland supplied the remainder. Production was by solar evaporation from sea water, saline lake water, and underground brines, and salt was also harvested from dry lake beds. Virtually the entire Western Australian output was exported, mainly to Japan; salt produced in Queensland, Victoria, and South Australia was generally for local consumption. Less than 2% of Australia's total output was consumed as table salt.

In Western Australia, production in 1978 and again in 1979 totaled 4.0 million tons of salt, and shipments totaled 3.6 million tons, valued at about $26.2 million in each of the 2 years. Texada Mines Pty. Ltd. was the principal producer, contributing over 1.5 million tons of salt to the State's output.

BHP, through its subsidiary Dampier Mining Co. Ltd., had a 76% interest in Texada Mines Pty. Ltd., with C. Itoh and Co. holding the remaining 14%. BHP's purchase of Texada in 1978 made it the first major salt exporter to have a majority Australian ownership. Texada Mines Pty. Ltd. output in 1978 and 1979 came from evaporation pans at Lake McLeod, north of Carnarvon, where extensive reserves of evaporites occur in brines over a 225,000-hectare area. The strata below the lake consisted of a layer of impure gypsum approximately 2 meters thick, underlain by halite (rock salt) to a depth of 15 meters. The amount of halite was estimated to exceed 3 million tons.

The halite was impregnated with saturated brine that contained about 21% sodium chloride. The brine was extracted from the halite bed by large capacity pumps and flowed to the crystallizing pan area. Roughly 25 crystallizer pans, covering an area of 800 hectares, were used for production. Each pan, with salt deposited about 300 millimeters thick, was harvested once a year. Harvesting proceeded throughout 1978 and 1979 as various pans were cleared in sequence and then refilled with brine.

Leslie Salt at Port Hedland, sold all its interests to Cargille Inc. of Minneapolis, U.S.A., in 1978. The company produced about 1.0 million tons of salt in 1978, well below its design capacity. Although production declined slightly, the crystallizer capacity was increased by approximately 20%. The company shipped to markets in the Philippines, the Republic of South Africa, Japan, Korea, New Zealand, and Taiwan.

In 1978, Lefroy Salt produced 200,000 tons from its operations on Lake Lefroy, where reserves were estimated at several hundred million tons. Four new crystallizers were completed in late 1978, but only one was used during 1979. A fourth washline was added during the year.

Responding to increased domestic requirements, South Australia's salt output in 1978 and 1979 was significantly above that for 1977. The State's major producers were Imperial Chemical Industries of Australia and New Zealand Ltd. (ICIANZ), Waratah Gypsum Pty. Ltd., Ocean Salt Pty. Ltd., and BHP. ICIANZ produced a combined total of 600,000 tons from sea water by solar evaporation at Dry Creek in 1978 and 1979. Waratah Gypsum Pty. Ltd. produced around 85,000 tons of salt from Lake MacDonnell, and BHP produced about 60,000 tons at Whyalla. These three companies accounted for about 75% of the State's total output.

Queensland's principal producer was ICIANZ, which operated a solar evaporation project near Rockhampton, utilizing underground brine. Production capacity was about 150,000 tons annually. In Victoria, virtually all the State's output was produced by Cheetham Salt Ltd. The company operated solar evaporation pans near Laverton on Port Phillip Bay, at Lara and Geelong on Corio Bay, and at Sea Lake near Lake Tyrrel. For each of the 2 years, 1978 and 1979, the company produced approximately 115,000 tons of salt.

Sulfur.—There were no known deposits of native sulfur in Australia, but pyrite was mined for its sulfur content at several locations, and four oil companies have sulfur recovery units. Sulfur was consumed mainly (93%) in the form of sulfuric acid to produce fertilizer, particularly superphosphate. Approximately 70% of sulfuric acid production was from imported brimstone and 30% from indigenous raw materials, principally zinc concentrates, pyrite concentrates, and lead concentrates.

Sulfur was also obtained from petroleum by Petroleum Refineries (Australia) Pty. Ltd. at Altona, Victoria, and Hallett's Cove, South Australia; Shell Refining (Australia) Pty. Ltd. at Clyde, New South Wales, and Geelong, Victoria; Australian Oil Refining Pty. Ltd. at Kernell, New South Wales; and Amoco (Australia) Pty. Ltd. at Bulwer Island, Queensland. The combined capacity of the plants was up to 52,000 tons per year, but the total output from petroleum in 1978 and 1979 was about 13,000 tons.

Only Electrolytic Zinc Co. of Australia Ltd. at Rosebery and the Mount Lyell Mining and Railway Co. Ltd. produced pyrite for acid production as a byproduct of base metal mining. Acid from this pyrite was produced at Burnie, Tasmania, by North-West Acid Pty. Ltd. in which the mining companies each have a half interest. The production by North-West Acid totaled about 320,000 tons of sulfuric acid in 1978 and 335,000 tons in 1979, compared with 318,100 tons in 1977.

Exploration work continued on pyrite black slate occurrences near Port Sorell and at Dial Range, both located in Tasmania. Tin deposits at Mount Bischoff and Renison Bell, also in Tasmania, are associated with enormous deposits of pyrite and pyrrhotite and were being investigated.

MINERAL FUELS

Coal.—Responding to a relatively firm demand, Australia's production, consumption, and export of black coal continued to grow during 1978 and 1979. Increased production from the largest coal-producing State (New South Wales), more than offset the slight decrease in Queensland in 1978 and 1979. Production increased in Western Australia and Tasmania, but output in South Australia remained at about the 1977 level. Though sales increased during 1978 and 1979, stocks continued to rise and at yearend were higher than at the end of 1977; the excess of production over sales was mainly coking coal.

The increase in domestic coal consumption in 1978 and 1979 was owing to electricity and steel demand, and the 8% increase in 1978 exports was owing to demand from the United States and Europe, resulting from the U.S. coal miners' strike. The value of black coal produced in 1978 and 1979 was higher than that of any other mineral commodity and so was the value of exports. The proportion of coal won by open pit mines remained at about 50% in 1978 and 1979.

The influence of two factors on the Australian coal industry became more apparent during 1978 and 1979. Both factors were associated with the continuing recession in the steel industry worldwide, particularly in Japan. The recession depressed the demand for coking coal, and some producers in Queensland and New South Wales successfully negotiated contracts for steaming coal in order to maintain or even increase the total amount of coal exported. This, in turn, directed attention to large deposits of good steaming coal that previously aroused little interest for export. The second factor was the increasing emphasis on diversifying the export destinations so that companies were less dependent on any one market such as the Japanese steel industry. This policy led to contractual sales to Israel, Brazil, the Republic of South Korea, Romania, the United Kingdom, and others.

New South Wales currently produces 55% of all coal mined in Australia. Production in 1978 and 1979 was about 51 million tons, mainly because of a substantial increase in output in the South Coast district and the Singleton North West district. The industry was preparing for large-scale expansion to serve markets both at home and abroad, but in the short-term growth in the market for New South Wales coal was being adversely affected by the worldwide recession in the steel industry. Nevertheless, development of the coal industry was proceeding. In 1978 and 1979, 10 major mines were under development, and a number of other mines were being planned or under investigation. These included a number of large surface mines in the Singleton district and proposals by the Electricity Commission for the establishment of new underground mines near Lithgow and Wakefield. The total planned production capacity for these new mines was 12 million tons of coal annually. A significant proportion of this new capacity would serve to replace declining output from existing mines. All these projects were scheduled to be in production by mid-1980.

Output in Queensland, which accounted for 36% of Australia's coal production, declined slightly in 1978 and 1979, mainly because of industrial problems. However, with the development of new mines in Central Queensland, such as Norwich Park, German Creek, Oakey Creek, and Gregory, coal production was expected to expand considerably within the next few years. In 1979, 20 underground and 23 surface mines were operating in the State. The upsurge in surface mining began in Queensland in the early 1970's when Utah Development Co. (owned 89.2% by Utah International Inc. of the United States and 10.8% by Utah Mining Australia Ltd.) started coal production. The company operated three open pit coal mines on the western side of the Bowen Basin, at Goonyella, Peak Downs, and Saraji in the Mackay coal mining district, producing over 50% of Queensland's total coal output; most of which was exported. Development work in a fourth open pit mine at Norwich Park, near Saraji began in 1979.

Another Queensland coal producer, Thiess Dampier Mitsui Coal Pty. Ltd., was considering a $25 million expansion program to boost output at its Moura-Kianga surface mine from 3 million tons to 5 million tons by 1985. The company also planned to develop two new underground mines in addition to its two existing underground mines. The company has exported coal only to Japan but was examining the prospects in other markets, including the Republic of South Korea, Taiwan, Europe, the United Kingdom, and the Pacific Basin. Houston Oil and Mineral Australia Inc. plans to complete its Oakey Creek open pit coal operation in Queensland by late 1980. At present, 200 people are employed at the mine site. A large bulk test open pit has been developed and samples sent to 20 countries.

Black coal reserves in Australia were estimated at 229 billion tons at yearend 1979, of this total 35 billion tons was indicated and 194 billion tons inferred. Indicated reserves were located in New South Wales (16 billion tons), Queensland (15.6 billion tons), Western Australia (1.8 billion tons), South Australia (730 million tons), and Tasmania (140 million tons). Substantial deposits of coal have also been delineated in areas not being mined, notably in the Surat Basin (Queensland), at Lake Phillipson in the Arckaringa Basin (South Australia), and in the Corrabin-Oaklands Basin (New South Wales).

Lignite.—Victoria was the only State that produced lignite in 1978 and 1979. The major deposits in Victoria were in the Latrobe Valley, 130 to 200 kilometers southwest of Melbourne, where the State Electricity Commission at Yallourn and Morwell produced more than 95% of the State's total output. The remainder was produced by privately owned mines at Anglesea and Bacchus Marsh. Coal was won by large dredges with an excavating capacity of 2,000 tons per hour. The Yallourn open pit produced at a rate of 13 million tons annually. Traditionally, production from Yallourn has been used to produce a high-grade solid fuel in the form of briquets for domestic and industrial use. However, briquet was also used as a basis for the production of high-grade char, gas, liquid fuel products, and other chemical industry feedstocks.

Research into production of oil from coal was being sponsored by several governments and private companies. Japanese interests were reported to be willing to establish a demonstration plant for conversion of Victorian lignite into solvent-refined coal suitable for steelmaking. Establishment of a full-scale plant was proposed if the demonstration proves successful.

In 1979, brown coal reserves were estimated at 122 billion tons (67 billion tons indicated and 55 billion tons inferred). Victoria has 66.7 billion tons of indicated reserves (12.2 billion tons saleable), and the remainder was in the Saint Vincent Basin of South Australia.

Petroleum and Natural Gas.—Australia's production of natural gas increased significantly in 1978, but crude petroleum output was only marginally higher. Of the total, about 145 million barrels was from the Gippsland Basin (Bass Strait) Victoria's offshore fields, 12 million barrels from the Barrow Island field in Western Australia, and the balance from the declining Moonie and Alton fields in the Surat Basin in Queensland. Production in 1979 was comparable, with the Bass Strait the principle source. Production represented about 65% of current domestic requirements, but with recent small discoveries and revised estimates of reserves, this degree of self-sufficiency could be maintained until the mid-1980's.

Input of crude oil and other feedstock to Australian refineries totaled about 300 million barrels in 1978. Indigenous crude oil comprised about 65% of this total; the balance was imported, mainly from the Middle East.

The Commonwealth Government dropped the price fixing arrangement under which domestic crude was sold at a price unrelated to world parity, and most Australian crude was sold at import parity prices. This has provided an incentive to intensify the search for new resources, and expenditures in 1979 were estimated at $130 million. The number of exploration wells rose to 52, and a minimum of 83 were planned for 1980. An additional bonus for the oil industry was the opening up of the high potential offshore Exmouth Plateau for petroleum exploration. In water depths up to 700 meters, the costs and technical problems will exceed those encountered in most other Australian projects.

The biggest news in development, however, remains the North West Shelf Natural Gas Development Project in Western Australia. A consortium comprising the BHP Co., Shell Oil Co., Woodside Petroleum Co., British Petroleum, and California Asiatic Oil Co. was continuing a feasibility study that could lead to production by 1984. The aim of the North West Shelf project is to produce gas and condensate from the North Rankin field, pipe it to shore, and process it into pipeline-quality gas, liquefied natural gas (LNG), and condensate suitable for markets in Australia and abroad. In 1979, the Federal Government approved the export of 55% of the current estimated reserves from the project. Approximately 6.5 million tons of LNG could thus be exported annually over a 20-year period. A contract has been signed between the consortium and the Western Australian State Energy Commission for the sale of up to 10.5 million cubic meters of gas per day over a 20-year period. This would be delivered to customers in the southwest of the State through a 1,300-kilometer-long pipeline from Dampier.

Uranium.—Australia is expected to become a major force in the world uranium market within the next few years, when production is initiated in the Northern Territory. After long delays owing to a ban on uranium mining by the former Government, pressures from environmentalists, and problems with aboriginal claims, a number of projects were moving ahead. However, the Mary Kathleen Mine in Queensland was the only one in production in 1978 and 1979.

Mary Kathleen Uranium Ltd. (MKU) produced 608 tons of U_3O_8 in 1978 and 800 tons in 1979. Those figures were significantly above the 1977 total of 420 tons. The rising production levels indicate that most of the difficulties that beset the company in 1977 and early 1978 have been resolved. The installation of new equipment in 1979 and the completion of $6 million worth of modifications could lift the production rate even higher. MKU is an open pit mine in which ore was mined by conventional drilling, blasting, loading, and hauling equipment. The mine consisted of a series of benches cut into the hill slope to a height of 105 meters above the valley floor and extended to 60 meters below. The ore was processed on site, and high-grade yellow cake was railed from the mine to Brisbane and shipped to the United States, the Federal Republic of Germany and Japan.

In 1977, the Federal Government accepted the findings of an extensive public inquiry and gave approval for uranium mining to proceed under stringent conditions relating to export controls and safeguards. This decision aroused vehement opposition, but the main cause of the delay was negotiations required by provisions of the Aboriginal Land Right Act. Under this act, the aborigines have the right to claim royalties and compensation for the use of tribal lands, and each developer must conclude an agreement with the Northern Land Council before any mining can proceed. Negotiations in 1978 led to an agreement that allows development of the Ranger project.

In addition to Ranger Uranium Mines Pty. Ltd., Queensland Mines Ltd. (Nabarlek) entered the construction stage of development in 1979. Also, WMC's environmental impact statement, a prerequisite for development of the Yeelirrie uranium project, was approved by the Western Australia State Government and the Federal Government in 1979. The company plans to construct a metallurgical research plant in Kalgoorlie.

Measured reserves in four large deposits in the Northern Territory total 297,000 tons U_3O_8 comprising Jabiluka, 127,000 tons; Ranger, 100,000 tons; Koongarra, 15,000 tons; and Nabarlek, 10,000 tons. The planned initial rate of production was 9,000 tons per year.

The Yeelirrie deposit in Western Australia has measured reserves of 46,000 tons U_3O_8, the Beverley and Mount Painter deposits in South Australia have 16,000 tons, and remaining reserves at Mary Kathleen totaled about 7,500 tons. The combined total of 366,500 tons U_3O_8 in seven deposits was considered available for immediate development. Numerous other prospects were under investigation throughout the country.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Australian dollars ($A) to U.S. dollars at the rate of $A1.00=US$1.15.

The Mineral Industry of Austria

By William F. Keyes[1]

Austria's economic performance during 1978 and 1979 was generally satisfactory. One of the strongest areas of the economy during this period was export sales. The Austrian schilling (AS) which is generally linked with the West German mark, remained firm, and the current account deficit decreased from AS49 billion[2] in 1977 to AS30 billion in 1978.

The country was nevertheless threatened by economic stagnation after a quarter century of annual growth at a rate of 4% to 5%, although conditions improved somewhat late in 1979. The Government reacted by introducing a three-phase program aimed at countering persistent budget and external payments deficits. The objectives of this program were 1) to cut consumption through a credit squeeze, 2) to apply a policy that would restrict wage settlements, and 3) to provide investment incentives. This last policy was instituted in the State-owned steel industry, which had no plans to expand production, but which continued to invest in more modern and efficient equipment. Under the program, purchases of new equipment were to be largely financed by the Government.

The minerals and metals industry of Austria was only a small factor in the economy. Iron ore, petroleum, natural gas, and coal (lignite) were produced in amounts that were less than sufficient for the domestic economy, but the country was self-sufficient in or had an export surplus of magnesite and steel. There was a small amount of domestic mine production of a number of nonferrous and nonmetallic minerals. Employment in the mining industry totaled 13,500 workers at the beginning of 1979, reflecting a decline of 7% since 1978 and about 15% since 1976.

PRODUCTION

Production of minerals in Austria is suffering a long-term decline, with no apparent relief in sight, since most mines have been known and exploited for many decades, or even centuries. Table 1 reports minerals production for each of the past four years.

Table 1.—Austria: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum metal:				
Primary	88,670	91,815	91,284	[1]92,693
Secondary	49,235	39,773	38,382	NA
Antimony, mine output, metal content	533	512	509	540
Cadmium metal	29	26	33	35
Copper:				
Mine output, metal content of ore	1,138	--	--	--
Metal:				
Smelter	13,000	12,100	12,100	13,200
Refined, including secondary	28,589	31,707	31,485	31,500
Germanium, metal content of concentrates kilograms	4,700	4,000	4,270	4,000
Iron and steel:				
Iron ore and concentrate, gross weight thousand tons	3,784	3,449	2,788	[1]3,260
Pig iron do.	3,318	2,965	3,077	[1]3,702
Ferroalloys, electric-furnace do.	8	7	NA	9
Crude steel do.	4,477	4,093	4,335	4,900
Semimanufactures do.	3,510	3,348	3,724	NA
Lead:				
Mine output, metal content of ore	4,373	4,292	4,633	5,000
Metal, smelter:				
Primary	6,336	6,315	5,772	7,500
Secondary	9,855	10,536	9,316	8,500
Manganese, Mn content of domestic iron ore	70,595	64,734	51,351	50,000
Tungsten, mine output, metal content	541	1,116	1,179	1,180
Zinc:				
Mine output, metal content of ore	17,623	19,702	22,479	20,000
Metal, refined	16,547	16,744	21,655	23,000
NONMETALS				
Barite	81	192	242	--
Cement, hydraulic thousand tons	5,880	5,993	5,735	[1]5,664
Clays:				
Illite	297,663	464,888	395,103	[1]379,042
Kaolin:				
Crude	270,742	272,250	275,695	250,000
Marketable	71,579	74,147	77,000	70,000
Other	[2]41,896	[2]68,060	98,546	[1]46,073
Diatomite	1,882	242	536	540
Feldspar, crude	3,800	3,645	2,886	2,700
Graphite, crude	33,057	35,288	40,501	41,000
Gypsum and anhydrite, crude	770,219	655,313	695,000	750,000
Lime thousand tons	959	969	1,016	920
Magnesite:				
Crude do.	927	1,003	982	1,000
Sintered or dead-burned do.	401	372	421	[1]423
Caustic calcined do.	125	123	127	[1]121
Nitrogen: N content of ammonia do.	456	465	470	470
Pigments, mineral: Micaceous iron oxide	10,627	9,805	10,560	10,000
Pumice (trass)	11,683	8,847	8,944	10,000
Salt:				
Rock thousand tons	1	1	1	1
In brine:				
Evaporated do.	332	323	321	320
Other do.	245	146	156	160
Total do.	578	470	478	481
Sand and gravel:				
Quartz sand do.	801	872	821	[1]885
Industrial sand do.	140	NA	NA	NA
Other sand and gravel do.	8,092	8,329	9,767	[1]9,900
Total do.	9,033	9,201	10,588	[1]10,785
Sodium Compounds:[e]				
Sodium carbonate synthetic do.	168	168	170	170
Sodium sulfate, synthetic do.	55	55	55	55
Stone:[3]				
Dimension stone do.	61	NA	NA	NA
Quartz and quartzite do.	205	155	203	[1]218
Other quarry and broken stone do.	1,912	NA	NA	NA
Total do.	2,178	NA	11,772	NA
Sulfur:				
Byproduct:				
Of metallurgy	8,173	7,774	8,836	10,000
Of petroleum and natural gas	17,877	24,624	22,586	25,000
From gypsum and anhydrite	23,184	26,776	26,775	25,000
Total	49,234	59,174	58,197	60,000
Talc and soapstone	100,648	103,743	106,848	110,000

See footnotes at end of table.

Table 1.—Austria: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS				
Coal, brown, and lignite ---- thousand tons	3,215	3,127	3,076	[1]2,741
Coke	1,615	1,458	1,484	[1]1,686
Gas, natural:				
Gross ---- million cubic feet	75,721	84,502	85,247	84,500
Marketed ---- do	69,093	77,630	75,280	74,600
Natural gas liquids, condensate ---- thousand 42-gallon barrels	138	170	170	165
Oil shale	930	420	970	NA
Petroleum:				
Crude ---- thousand 42-gallon barrels	13,466	12,462	12,486	[1]12,044
Refinery products:				
Gasoline ---- do	13,422	12,903	13,189	[1]14,934
Jet fuel ---- do	1,135	732	1,003	[1]904
Kerosine ---- do	96	183	--	[1]84
Distillate fuel oil ---- do	18,345	17,546	19,683	[1]20,978
Residual fuel oil ---- do	25,683	23,684	28,560	[1]29,544
Lubricants ---- do	1,221	1,198	1,171	[1]1,211
Liquified petroleum gas ---- do	1,334	1,414	1,416	[1]1,833
Bitumen ---- do	2,127	2,385	2,214	[1]2,284
Other ---- do	3,364	3,591	3,976	[1]3,766
Refinery fuel and losses ---- do	2,313	2,524	3,539	[1]735
Total ---- do	69,040	66,160	74,751	[1]76,273

[e] Estimate. [p] Preliminary. NA Not available.

[1] Reported figure.

[2] Excluding clay sand.

[3] Excluding stone used by the cement and iron and steel industries.

TRADE

Austria imports most of its requirements for crude minerals and finished metals. Exports of a few domestically produced nonmetallic minerals are of some importance in world trade; these include magnesite, graphite, cement, talc, and kaolin. Exports and imports in 1977 and 1978 are shown in tables 2 and 3, respectively.

Trade with the United States in minerals and metals consists primarily of U.S. exports to Austria of phosphate rock, radioactive materials, and ammonia, and U.S. imports from Austria of aluminum, iron and steel semimanufactures, and ferroalloys.

Table 2.—Austria: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Oxide and hydroxide (includes manufactured corundum)	NA	38,347	Poland 8,904; Italy 4,557; United Kingdom 4,526.
Metal including alloys:			
Scrap	48,737	42,570	Italy 21,917; West Germany 19,892.
Unwrought	8,699	11,685	West Germany 5,799; Switzerland 3,384; Bulgaria 577.
Semimanufactures	54,731	65,393	West Germany 16,755; Switzerland 4,911; United States 3,937.
Antimony ore and concentrate	336	414	NA.
Cadmium metal including alloys, all forms ---- kilograms	7,500	20,000	All to Czechoslovakia.
Chromium:			
Chromite	829	923	West Germany 575; Italy 301.
Oxide	[r]24	1	NA.
Columbium and tantalum: Tantalum metal including alloys, all forms ---- kilograms	10,300	10,200	NA.
Copper:			
Ore and concentrate	550	91	Sweden 88.
Copper sulfate	330	1,618	Italy 1,617.
Metal including alloys, all forms:			
Scrap	1,304	2,474	Netherlands 846; West Germany 605; United Kingdom 502.

See footnotes at end of table.

Table 2.—Austria: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Copper —Continued			
Metal including alloys, all forms —Continued			
Unwrought	13,471	18,663	West Germany 6,258; Italy 5,756; Switzerland 3,364.
Semimanufactures	9,488	13,655	West Germany 3,078; Italy 2,064; France 1,635.
Gold metal, unworked or partly worked troy ounces	15,786	12,249	West Germany 10,417.
Iron and steel:			
Ore and concentrate, except roasted pyrite	334	85	All to West Germany.
Metal:			
Scrap	7,530	7,344	Italy 2,940; Switzerland 2,607; West Germany 1,579.
Pig iron, ferroalloys, similar materials	11,997	11,312	NA.
Steel, primary forms thousand tons	311	431	West Germany 245; Yugoslavia 82; Italy 49.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	286	305	West Germany 95; Italy 62; Switzerland 34.
Universals, plates, sheets do	1,022	1,063	West Germany 324; U.S.S.R. 244; Italy 100.
Hoop and strip do	97	82	Switzerland 18; West Germany 13; Poland 13.
Rails and accessories do	80	87	Switzerland 23; Romania 10; Argentina 9.
Wire do	48	55	West Germany 13; Hungary 10; Switzerland 7.
Tubes, pipes, fittings do	147	163	West Germany 32; Denmark 23; Switzerland 22.
Castings and forgings, rough do	10	13	West Germany 6; Sweden 4.
Lead:			
Metal including alloys, all forms	1,431	686	Yugoslavia 626; West Germany 27; Netherlands 21.
Magnesium metal including alloys, all forms	651	702	West Germany 374; Italy 243.
Manganese oxide	82	78	Brazil 56; Mexico 12.
Mercury 76-pound flasks	226	818	Netherlands 571; West Germany 189.
Molybdenum metal including alloys, all forms	922	872	NA.
Platinum-group and silver metals including alloys, all forms:			
Platinum-group troy ounces	6,977	7,652	Romania 5,305; Denmark 675; West Germany 386.
Silver:			
Bullion thousand troy ounces	460	775	West Germany 740; Yugoslavia 32.
Other (powder) do	10	NA	
Semimanufactures do	698	1,138	Yugoslavia 1,116; France 13.
Tin:			
Oxide	2	NA.	
Metal including alloys, all forms	32	96	United Kingdom 53; Denmark 17.
Titanium oxide	44	65	West Germany 44; Switzerland 21.
Tungsten:			
Ore and concentrate	252	130	West Germany 70; United Kingdom 40; United States 20.
Metal including alloys, all forms	363	591	NA.
Zinc:			
Ore and concentrate	6,600	NA.	
Oxide	98	34	Turkey 20.
Metal including alloys, all forms	486	863	West Germany 367; Czechoslovakia 300; Switzerland 100.
Other:			
Ores and concentrates	104	78	All to West Germany.
Ash and residue containing nonferrous metals	61,427	64,346	Italy 46,009; West Germany 14,906; Spain 2,302.
Waste and sweepings of precious metals kilograms	29,743	38,168	West Germany 37,650; United Kingdom 332.
Oxides, hydroxides, peroxides of metals	1,125	1,582	West Germany 820; Italy 707.
Base metals including alloys, all forms	1,564	4,719	United Kingdom 2,578; United States 1,075; Italy 906.
NONMETALS			
Abrasives:			
Natural: Pumice, emery, natural corundum, other	39	17	NA.

See footnotes at end of table.

Table 2.—Austria: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Abrasives —Continued			
Grinding and polishing wheels and stones	13,106	12,934	West Germany 1,735; Romania 1,360; Poland 1,227.
Asbestos	102	80	East Germany 68.
Cement	71,288	29,242	Yugoslavia 13,856; West Germany 10,854; Hungary 3,541.
Chalk	3,432	5,980	West Germany 3,082; Hungary 1,654; Yugoslavia 596.
Clays and clay products (including all refractory brick):			
Crude:			
Kaolin (china clay)	13,404	21,271	Italy 11,611; Hungary 6,258; Yugoslavia 2,533.
Other	329	199	Hungary 90; Czechoslovakia 58.
Products:			
Refractory (including nonclay brick)	157,682	168,117	France 27,880; West Germany 27,351; Sweden 10,288.
Nonrefractory	18,563	26,280	West Germany 22,964; Switzerland 2,197.
Diamond:			
Industrial value	$65,408	$6,680	NA.
Other, worked do.	NA	$136,896	West Germany $86,076; Belgium-Luxembourg $50,544.
Diatomite and other infusorial earth	1,058	1,027	Yugoslavia 846; Romania 85; West Germany 54.
Feldspar	23	NA.	
Fertilizer materials:			
Crude, unspecified	4	NA.	
Manufactured, phosphatic	28,749	38,511	Czechoslovakia 28,079; Hungary 10,432.
Fluorspar	2	NA.	
Graphite, natural	16,859	17,787	Poland 7,959; West Germany 6,547; Italy 1,098.
Gypsum and plasters	165,801	189,752	West Germany 169,315; Italy 14,256; Hungary 6,134.
Lime	1,738	1,955	West Germany 1,566; Hungary 173; Switzerland 135.
Magnesite	103,045	109,536	West Germany 15,871; Poland 14,538; Hungary 8,576.
Mica, all forms	71	156	Yugoslavia 30; West Germany 18; Czechoslovakia 17.
Pigments, mineral, including processed iron oxides	6,213	6,905	West Germany 2,085; United Kingdom 1,310; Netherlands 980.
Precious and semiprecious stones, including diamond:			
Natural kilograms	960	2,306	West Germany 1,179; United Kingdom 287; Switzerland 198.
Manufactured do.	2,135	2,164	United States 528; West Germany 394; Yugoslavia 103.
Pyrite	--	44	NA.
Salt	54	48	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous including marble and limestone	69,205	76,671	West Germany 61,355; Switzerland 15,229.
Slate	7	37	NA.
Other	47,229	70,863	West Germany 70,428.
Worked:			
Paving and flagstone	7,954	13,114	West Germany 7,777; Switzerland 5,264.
Slate	33	27	NA.
Other	1,651	2,942	West Germany 2,322; United States 159.
Dolomite	12,912	8,508	West Germany 5,021; France 1,094; Yugoslavia 792.
Gravel and crushed rock	373,133	430,665	Switzerland 245,640; West Germany 179,068.
Limestone	4	30	NA.
Quartz and quartzite	440	134	NA.
Sand, excluding metal bearing	110,640	126,716	West Germany 64,985; Switzerland 48,067; Hungary 7,961.
Sulfuric acid, oleum	4,740	8,111	West Germany 3,474; Italy 2,441; Yugoslavia 1,117.
Talc, steatite, soapstone, pyrophyllite	87,811	87,097	West Germany 45,147; Italy 11,938; Switzerland 6,472.

See footnotes at end of table.

Table 2.—Austria: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Other:			
Crude	4,805	4,028	West Germany 3,664; Netherlands 109.
Slag, dross, and similar waste, not metal bearing	27,275	34,648	West Germany 28,328; Italy 6,064.
Oxides and hydroxides of magnesium, strontium, barium	63	(1)	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	6	15	NA.
Carbon black and gas carbon	63	10	NA.
Coal:			
Anthracite and bituminous, including briquets	6	28	NA.
Lignite and lignite briquets	8,429	5,433	West Germany 5,429.
Coke and semicoke	68,654	63,805	Romania 62,033; West Germany 586; Italy 527.
Gas, manufactured	26,806	34,412	Italy 25,749; Czechoslovakia 6,664; Yugoslavia 1,993.
Hydrogen, helium, rare gases thousand cubic feet	53,664	54,089	Hungary 30,134; West Germany 11,671; Czechoslovakia 9,510.
Peat, including peat briquets and litter	10	3	NA.
Petroleum refinery products:			
Gasoline, aviation and motor thousand 42-gallon barrels	(1)	52	Yugoslavia 50.
Kerosine and jet fuel do	--	(1)	NA.
Distillate fuel oil do	1	1	All to Czechoslovakia.
Residual fuel oil do	345	239	Czechoslovakia 198; Poland 40.
Lubricants do	[r]629	642	Czechoslovakia 284; Poland 119; Yugoslavia 103.
Other do	582	50	NA.
Total do	1,557	984	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	16,702	14,526	West Germany 7,635; Yugoslavia 4,645; Italy 979.

[r] Revised. NA Not available.

[1] Less than 1/2 unit.

Table 3.—Austria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite	34,233	40,226	NA.
Oxide and hydroxide	210,243	217,583	West Germany 13,072; France 3,138.
Metal including alloys:			
Scrap	55,838	47,061	NA.
Unwrought	19,246	14,891	Norway 7,680; West Germany 3,870; Hungary 1,149.
Semimanufactures	28,455	29,235	West Germany 14,790; Switzerland 4,435; Hungary 1,794.
Antimony:			
Ore and concentrate	202	125	Canada 100; China, Mainland, 25.
Metal including alloys, all forms	92	52	Belgium-Luxembourg 50.
Arsenic trioxide, pentoxide, acids	26	24	NA.
Cadmium metal including alloys, all forms	6	4	West Germany 3.
Chromium:			
Chromite	85,492	61,947	Republic of South Africa 26,784; Iran 13,352; Turkey 7,140.
Oxide and hydroxide	328	321	West Germany 219; U.S.S.R. 72; Poland 10.
Cobalt oxide and hydroxide kilograms	4,700	6,100	West Germany 3,700; Belgium-Luxembourg 2,000.
Columbium and tantalum: Tantalum metal including alloys, all forms do.	18,600	15,100	West Germany 6,100; United States 5,900; Belgium-Luxembourg 2,100.
Copper:			
Ore and concentrate	4	8	NA.
Copper sulfate	322	349	France 134; Italy 113; Belgium-Luxembourg 50.
Metal including alloys:			
Scrap	12,115	15,601	West Germany 7,371; Hungary 4,316; Switzerland 2,142.
Unwrought	22,416	21,378	Republic of South Africa 7,781; West Germany 7,234; Albania 2,534.
Semimanufactures	39,072	43,490	West Germany 24,391; United Kingdom 8,269; Sweden 3,409.
Gold metal, unworked or partly worked thousand troy ounces	328	263	Republic of South Africa 111; Switzerland 64; West Germany 56.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	2,611	2,619	Brazil 1,332; U.S.S.R. 752; Liberia 297.
Roasted pyrite do.	113	54	West Germany 42; Italy 9; Yugoslavia 3.
Metal:			
Scrap do.	79	116	West Germany 65; Czechoslovakia 20; U.S.S.R. 11.
Pig iron, cast iron, similar materials[1] do.	96	144	U.S.S.R. 40; Romania 33; East Germany 17.
Ferroalloys:			
Ferromanganese do.	18	20	Norway 12; West Germany 4; Yugoslavia 2.
Other do.	^{r}50	56	U.S.S.R. 9; Yugoslavia 8; Norway 6; Sweden 5.
Steel, primary forms do.	^{r}193	330	West Germany 86; Romania 82; Czechoslovakia 48.
Semimanufactures:			
Bars, rods, angles, shapes, sections do.	199	200	West Germany 83; Italy 70; Switzerland 20.
Universals, plates, sheets do.	197	164	West Germany 86; France 20; Italy 20.
Hoop and strip do.	52	51	West Germany 34; Switzerland 6; Italy 3.
Rails and accessories do.	3	4	West Germany 2; Switzerland 1.
Wire do.	^{r}19	23	West Germany 7; Belgium-Luxembourg 4; France 3.
Tubes, pipes, fittings do.	148	205	West Germany 108; France 39; Italy 20.
Castings and forgings, rough do.	10	9	West Germany 7.
Lead:			
Ore and concentrate	7,822	4,258	All from Italy.
Oxide	738	810	Italy 653; West Germany 80; France 35.
Metal including alloys:			
Scrap	2,114	1,203	Switzerland 1,080; West Germany 120.
Unwrought	23,198	24,510	West Germany 7,712; Yugoslavia 7,293; Denmark 2,751.
Semimanufactures	736	821	West Germany 803.
Magnesium metal including alloys, all forms	2,179	1,908	Norway 1,222; West Germany 248; United States 153.

See footnotes at end of table.

Table 3.—Austria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Manganese:			
Ore and concentrate	643	520	Morocco 174; Netherlands 173; West Germany 130.
Oxide	167	149	West Germany 120.
Mercury 76-pound flasks	380	'415	Italy 148; Sweden 99.
Molybdenum:			
Oxide	1,489	1,375	NA.
Metal including alloys, all forms	44	87	West Germany 56; Netherlands 15; Canada 10.
Nickel:			
Matte, speiss, similar materials	1,278	1,362	Cuba 605; United States 320; Netherlands 248.
Metal including alloys:			
Scrap	2,767	263	West Germany 159; Netherlands 83; Hungary 11.
Unwrought	2,288	2,400	United States 546; Republic of South Africa 392; United Kingdom 282.
Semimanufactures	1,263	627	West Germany 221; United States 209; United Kingdom 110.
Platinum-group and silver metals including alloys, all forms:			
Platinum-group troy ounces	54,045	75,200	West Germany 70,667; United Kingdom 2,090; Switzerland 1,222.
Silver:			
Bullion thousand troy ounces	9,983	7,256	France 2,160; Switzerland 1,572; United Kingdom 1,346.
Other (powder) do	9	51	All from West Germany.
Semimanufactures do	4,575	4,318	West Germany 3,604; United Kingdom 511; Switzerland 177.
Tin metal including alloys, all forms	574	574	West Germany 237; Thailand 169; Netherlands 45.
Titanium oxide	8,621	10,349	West Germany 6,178; France 1,123; Italy 1,032.
Tungsten:			
Ore and concentrate	2,205	4,533	NA.
Oxide and hydroxide	238	131	NA.
Metal including alloys, all forms	744	492	United States 131; West Germany 109; Belgium-Luxembourg 72.
Zinc:			
Ore and concentrate	2,200	1	NA.
Oxide	799	740	West Germany 627; France 45; United Kingdom 41.
Metal including alloys:			
Scrap and blue powder	398	1,166	Belgium-Luxembourg 528; Hungary 322; United Kingdom 138.
Unwrought	7,896	4,080	West Germany 2,961; Zambia 603; Netherlands 168.
Semimanufactures	1,414	1,982	West Germany 1,717; Yugoslavia 101; Poland 60.
Other:			
Ores and concentrates	10,361	10,207	United States 3,899; Australia 1,642; Netherlands 1,334.
Ash and residue containing nonferrous metals	97,369	102,681	U.S.S.R. 50,224; Hungary 15,272; East Germany 14,038.
Waste and sweepings of precious metals kilograms	513	2,966	Yugoslavia 2,957; Denmark 5; West Germany 4.
Oxides, hydroxides, peroxides of metals	2,690	3,804	Republic of South Africa 3,223; West Germany 358; Belgium-Luxembourg 93.
Base metals including alloys, all forms	6,240	2,622	U.S.S.R. 1,513; Republic of South Africa 321; Belgium-Luxembourg 271.
NONMETALS			
Abrasives:			
Natural: Pumice, emery, natural corundum, other	668	266	Italy 132; West Germany 55.
Dust and powder of precious and semiprecious stones (including diamond) kilograms	98	144	United States 123; Switzerland 15.
Grinding and polishing wheels and stones	936	935	West Germany 541; Italy 134; Yugoslavia 58.
Asbestos	39,074	30,807	Canada 13,078; U.S.S.R. 8,038; Republic of South Africa 5,393.
Barite and witherite	3,785	6,976	West Germany 3,622; Ireland 1,494; Czechoslovakia 1,147.
Boron materials:			
Crude natural borates	15,425	16,421	Turkey 9,137; United States 6,140; Italy 1,096.
Oxide and acid	758	851	France 769; West Germany 42; United Kingdom 11.

See footnotes at end of table.

Table 3.—Austria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Cement	37,243	40,255	Italy 12,156; West Germany 10,200; Yugoslavia 7,077.
Chalk	10,985	4,618	France 3,336; West Germany 704; Italy 408.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	651	541	West Germany 217; United States 201; Italy 76.
Kaolin (china clay)	96,950	102,546	Czechoslovakia 43,782; United Kingdom 33,582; West Germany 10,967.
Other	87,879	84,371	West Germany 45,601; Czechoslovakia 30,483; Poland 4,472.
Products:			
Refractory (including nonclay brick)	15,232	18,084	West Germany 12,349; Italy 1,096; France 962.
Nonrefractory	254,913	259,310	Italy 158,720; West Germany 76,658; Switzerland 10,432.
Cryolite and chiolite, natural	415	268	All from Denmark.
Diamond:			
Industrial value	$103,528	$80,154	West Germany $28,853; Netherlands $15,102; Republic of South Africa $14,048.
Natural:			
Crude do.	(2)	$174,356	Belgium-Luxembourg $149,842.
Worked carats	NA	105,000	West Germany 60,000; Israel 20,000; Belgium-Luxembourg 15,000.
Diatomite and other infusorial earth	9,570	7,206	Hungary 2,847; United States 1,918; Denmark 1,183.
Feldspar	6,713	5,948	Sweden 3,073; West Germany 1,683; Italy 1,015.
Fertilizer materials:			
Crude:			
Phosphatic	347,705	314,341	NA.
Potassic	24,738	19,231	East Germany 11,056; West Germany 8,175.
Other	2,825	3,401	West Germany 1,557; Italy 1,095; Switzerland 528.
Manufactured:			
Nitrogenous	68,736	80,817	West Germany 41,715; France 16,286; Hungary 11,576.
Phosphatic	113,935	79,328	France 34,312; Luxembourg 27,196; West Germany 14,373.
Potassic	297,461	271,901	NA.
Other, including mixed	72,682	97,915	West Germany 94,661; Yugoslavia 1,867.
Fluorspar	13,172	16,077	East Germany 7,918; West Germany 7,630.
Graphite, natural	779	1,614	North Korea 1,290; West Germany 235; Madagascar 48.
Gypsum and plasters	7,488	11,425	West Germany 10,498; Italy 475; Switzerland 290.
Lime	685	923	West Germany 538; Italy 311; United Kingdom 57.
Magnesite	88,589	88,561	Turkey 29,969; Italy 22,763; Israel 20,155.
Mica:			
Crude, including splittings and waste	313	340	West Germany 178; Norway 80; United Kingdom 46.
Worked, including agglomerated splittings	112	131	Belgium-Luxembourg 63; West Germany 19; Australia 13.
Pigments, mineral:			
Natural, crude	1,891	NA.	
Iron oxides, processed	3,454	2,907	West Germany 2,865; United Kingdom 34.
Precious and semiprecious stones, including diamond:			
Natural, crude thousand carats	173,820	[3]95,760	Brazil 50,060; West Germany 16,045; India 2,260.
Manufactured do.	61,890	84,770	Switzerland 43,575; France 35,815; U.S.S.R. 3,680.
Pyrite, gross weight	10,781	5,856	U.S.S.R. 5,230; Italy 473; West Germany 153.
Salt, including brine salt	29,597	63,397	West Germany 63,394.
Sand and gravel:			
Gravel, including crushed rock	289,441	405,025	West Germany 376,591; Italy 20,425; Czechoslovakia 7,059.
Sand, excluding metal bearing	480,325	597,619	West Germany 362,896; Czechoslovakia 215,746.
Stone, n.e.s.:			
Dimension stone:			
Crude and partly worked:			
Calcareous, including marble and limestone	9,003	6,580	Italy 4,168; West Germany 1,276; Hungary 694.

See footnotes at end of table.

Table 3.—Austria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Stone, n.e.s. —Continued			
Dimension stone —Continued			
Crude and partly worked —Continued			
Slate	1,368	1,223	France 648; West Germany 240; Norway 106.
Other	36,265	36,155	Italy 22,893; Republic of South Africa 6,528; Sweden 1,424.
Worked:			
Paving and flagstone	10,884	9,986	Italy 5,247; Romania 2,478; Yugoslavia 1,226.
Slate	398	513	Italy 147; Norway 101; France 84.
Dolomite, chiefly refractory grade	4,872	4,831	Italy 3,312; Norway 798; West Germany 541.
Limestone, except dimension	100	2,393	West Germany 2,288.
Quartz and quartzite	21,515	18,818	West Germany 14,049; Hungary 3,222.
Volcanic material (trass)	511	880	West Germany 827; Italy 53.
Sulfur:			
Elemental, all forms	97,803	101,556	West Germany 55,703; Poland 40,776; Hungary 3,827.
Sulfur dioxide	3,620	NA.	
Sulfuric acid, including oleum	1,846	1,376	West Germany 701; Switzerland 675.
Talc, steatite, soapstone, pyrophyllite	2,860	2,427	Italy 897; Norway 740; France 333.
Other:			
Crude:			
Meerschaum, amber, jet ... value	$363	NA	
Other	55,176	51,284	West Germany 22,360; Hungary 22,098; Mozambique 1,507.
Slag, dross, and similar waste, not metal bearing	48,134	50,451	Italy 30,253; West Germany 7,588; Republic of South Africa 6,694.
Oxides and hydroxides of magnesium, strontium, barium	718	561	West Germany 528.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,091	862	Trinidad and Tobago 690; West Germany 130; United States 38.
Carbon black and gas carbon	[4]23,542	22,522	West Germany 13,086; Italy 7,390; Canada 755.
Coal:			
Anthracite and bituminous, including briquets ... thousand tons	2,362	2,315	Poland 741; U.S.S.R. 686; Czechoslovakia 640.
Lignite and lignite briquets ... do.	518	511	Yugoslavia 216; East Germany 167; West Germany 94.
Coke and semicoke ... do.	964	919	Czechoslovakia 410; West Germany 232; Poland 182.
Gas, natural ... thousand cubic feet	85,909	98,062	U.S.S.R. 97,389; West Germany 671.
Hydrogen, helium, rare gases ... do.	[5]120,156	180,247	West Germany 166,900; Yugoslavia 9,467.
Peat, including peat briquets and litter	40,785	44,954	West Germany 27,036; U.S.S.R. 12,385.
Petroleum:			
Crude and partly refined:			
Crude ... thousand 42-gallon barrels	[r]50,384	59,754	U.S.S.R. 14,444; Iraq 13,868; Iran 11,596.
Refinery products:			
Gasoline, aviation and motor ... do.	7,204	6,228	Italy 3,395; West Germany 1,980; Hungary 390.
Kerosine ... do.	32	50	Italy 30; West Germany 15; Netherlands 4.
Distillate fuel oil ... do.	1,260	1,386	Italy 767; West Germany 322; East Germany 126.
Residual fuel oil ... do.	7,143	6,748	West Germany 3,071; Italy 1,470; East Germany 896.
Lubricants ... do.	[r]992	939	Hungary 164; Poland 127; Netherlands 126; West Germany 103.
Mineral jelly and wax ... do.	[r]109	111	West Germany 68; U.S.S.R. 14; Hungary 12.
Liquefied petroleum gas ... do.	[r]529	684	West Germany 304; Hungary 270; U.S.S.R. 43.
Other ... do.	[r]1,473	804	West Germany 255; Hungary 108; United Kingdom 43.
Total ... do.	[r]18,742	16,950	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	15,249	21,844	Poland 8,978; Romania 6,039; Netherlands 2,266.

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[r] Revised. NA Not available.

[1] Including spiegeleisen, powder, and shot.

[2] Included under "Precious and semiprecious stones."

[3] Excludes diamond.

[4] Excludes quantity valued at $484.

[5] Excludes quantity of unidentified rare gases valued at $94,633.

COMMODITY REVIEW

METALS

Aluminum.—At its Ranshofen smelter near Braunau-am-Inn, Vereinigte Metallwerke Ranshofen-Berndorf AG put a new aluminum scrap melting plant into operation. The plant was expected to save in energy costs, and it created 50 new jobs.

Iron Ore.—About 40% (by iron content) of the iron ore used by the Government-owned steel company, Vöest-Alpine Montan AG (VAM), was supplied from domestic mines, and the remainder was imported from overseas. In terms of gross weight, domestic ore production declined almost 20% from 1977 to 1978, to about 2.8 million tons containing 31% iron. Economic conditions were given as the cause. All domestic ore was supplied by three Vöest-Alpine mines; the Erzberg mine in Styria contributed about 85%; the Radmer mine near Erzberg contributed about 11%; and the declining Huettenberg mine, 70 kilometers southwest of Erzberg, contributed 4%.

Iron and Steel.—The financial condition of the Austrian steel industry, which consisted principally of VAM, the only primary steel producer, showed no significant improvement since 1977, which was the worst year for the industry since the end of World War II. VAM lost almost AS700 million (about $40 million) in 1978, compared with a loss of AS700 million to AS800 million in 1977. The forecast for 1979 was for a much smaller deficit, however. Crude steel production reached 4.8 million tons in 1978, reflecting an increase of 12% over that of 1977, and increased further to about 5.4 million tons in 1979.

VAM had no plans to increase output in the near future. However, a decision was made to build a second continuous caster at Donawitz that was expected to be ready for operation in 1980. The first continuous caster was commissioned in 1979, with a capacity of 800,000 tons per year, at a final cost of AS450 million. About 40% of Austrian steel was continuously cast in 1979, compared with 21% in 1975. Oxygen blown steel accounted for more than 80% of the total. Donawitz was also expected to get a new wire rod mill at a cost of AS1.4 billion as part of the investment program announced in 1977.

In September 1978, the newly appointed director general of the Österreichische Industrieverwaltungs AG (OIAG), the state holding company for VAM and other nationalized industries, called for financial assistance for the steel industry. A AS500 million bond issue was floated during 1978, but the director general noted that VAM was unable to internally generate the 75% of its investment needs that was called for by Government policy.

The transport of liquid pig iron between VAM's two plants at Donawitz and Linz, a distance of 215 kilometers, started in 1978. The iron, at a temperature of 1,380°C, is tapped from a blast furnace at Donawitz and run into torpedo ladles with capacities of 150 tons each. Two trains, each with two insulated ladles, make the journey to Linz in 5 1/2 hours, with a temperature loss of only 7°C per hour.

Lead-Zinc.—In 1978, expansion of the country's only zinc refinery at Gailitz (Arnoldstein), Carinthia, was completed, and production at the Bleiberg and Kreuth mines nearby was increased to about 39,000 tons of concentrate (or 22,000 tons of zinc) annually from the former level of 35,000 tons (17,000 tons zinc). These mines and the refinery were operated by Bleiberger Bergwerksunion AG, which is owned by the Austrian Government.

NONMETALS

Kaolin.—Production of marketable kaolin declined because of several years of low demand and competition from imports.

Two producers of kaolin operated three mines during the 1978-79 period. The Österreichische Kaolin-und Montanindustrie AG Nfg. KG (KAMIG) operated the Kriechbaum mine north of Schwertberg, 20 kilometers east of Linz, as well as the Weinzierl open pit mine east of Schwertberg. About 70% of KAMIG's crude kaolin came from Kriechbaum, and about 30% came from Weinzierl. A modernization program was completed, including an 8-kilometer pipeline from Kriechbaum to KAMIG's plant at Aisthofen, which was expanded. About a third of total Austrian kaolin production came from the Aspang surface mine of the Aspanger Kaolin und Steinwerke AG, located between Aspang and Zoberg, south of Vienna. Both KAMIG and Aspanger also produced byproduct quartz sand.

Magnesite.—The capacity of the Austrian magnesite industry was reported as 550,000 tons per year of dead-burned product and 145,000 tons per year of caustic calcined magnesite. Actual production of each of these products was at about 75% and 85% of capacity, respectively, from nearly 1 million tons of crude magnesite. The two basic refractory producers in the country were Österreichisch-Amerikanische Magnesit AG (OAMAG), which is controlled by General Refractories of the United States, and Veitscher Magnesitwerke AG, a subsidiary of Magnesia AG of Switzerland. Both are large producers, and both have been long established in the industry. Both produced a range of basic refractory bricks and monolithics based on their own production of raw materials plus imports of chromite and low-iron magnesite. Austria does not produce low-iron magnesite; it imported this material from the eastern Mediterranean region. OAMAG's capacity was reported to have reached 180,000 tons per year of magnesite and chrome-magnesite brick and 45,000 tons per year of monolithics.

Refractories.—The principal producer of non-basic refractories in Austria was Didier Werke GmbH, a subsidiary of Didier Werke AG of Wiesbaden, West Germany. The company, which produces mainly fire clay bricks, increased sales to eastern Europe as domestic demand weakened.

Talc.—About 90% of Austrian talc production came from the three mines operated by Talkumwerke Naintsch GmbH, a subsidiary of Talcs de Luzenac SA of France. These were Rabenwald-Krughof, northeast of Graz near Weiz; Lassing, near Liezen; and Weisskirchen, near Knittelfeld, which reportedly also produced a mixture of chlorite, mica, and quartz. Ore from Rabenwald was processed mainly at Anger, Oberfeistritz, and Stubenberg, principally for ceramics.

MINERAL FUELS

Coal.—Removal of overburden continued at the new open pit at the Oberdorf lignite mine operated by Graz-Köflacher Eisenbahn und Bergbaugesellschaft (GKB) near Barnbach (Voitsberg), Styria. The Wolfsegg-Traunthaler Kohlenwerk AG (WTK) was successful in introducing protective hoods in its underground hydraulic mines near Ampflwang, Upper Austria. At the Trimmelkam (Upper Austria) mine of Salzach Kohlenbergbau GmbH (SK), the old vertical shaft was replaced with an inclined shaft that notably increased output.

Test drilling northeast of the Trimmelkam mine located an apparently mineable coalfield, and full information on the field's reserves was expected to be developed by 1980. It was anticipated that the field could be used as the fuel source for an additional 150-megawatt generator at the Riedersbach power station, which already gets much of its fuel from Trimmelkam.

The Fohnsdorf (Styria) mine of GKB, producer of the harder grade of lignite known as glanzkohle, was closed by the company during 1978. As a result, total domestic production of coal declined slightly, to just over 3 million tons. About six lignite mines remained in operation; three were operated by GKB in Styria, two were operated by WTK in Upper Austria, and SK also operated a mine in Upper Austria.

Austria and Poland concluded an agreement late in 1979 for the sale of 1 million tons per year of Polish coal for 20 years. An option to take another 500,000 tons annually was reportedly not being considered by the Austrian Government because of a desire to broaden its base of supply by obtaining coal from other sources, such as the Republic of South Africa. A coal-based powerplant comprised of a 320-megawatt unit and a 380-megawatt unit was planned to be built at Duernrohr in Lower Austria, 3 miles from the site of the Zwentendorf nuclear powerplant; the latter failed to gain approval for operation in a popular referendum in 1978. The Duernrohr plant was expected to become a principal consumer of Polish coal.

Petroleum.—Two Austrian companies continued their exploration and exploitation drilling programs at the same levels as in 1977; some 13 rigs were reported at work. The State oil company, Österreichische Mineralölverwaltungs AG (OMV), drilled in the Vienna basin (northeast of Vienna), where four wells reached their ultimate depths, between 1,454 meters and 3,460 meters, with shows of oil. Three other wells in the basin were still being drilled, including the Zistersdorf UT-1, which was targeted at 7,500 meters and had reached 6,825 meters. Drilling was unproductive elsewhere in the basin, as well as in central Austria, and in the southwest on the Yugoslav border.

Rohoel-Aufsuchungs GmbH (RAG), a joint subsidiary of Shell and Mobil, drilled and abandoned the Oberminathal-5 well in central Austria and was preparing to begin drilling two other wells elsewhere.

A summit meeting of Government members and Socialist Party leaders was scheduled for early 1980 to obtain agreement on new legislation to replace the Energy Management Law of 1976, which expires in June 1980. In view of Austria's high dependence (68%) on imported energy, chiefly in the forms of oil and gas, it was expected that the new legislation would be aimed at giving the Government powers to decree energy conservation and control before—rather than after—a crisis develops.

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[1] Supervisory physical scientist, Branch of Foreign Data.
[2] AS14.0=US$1.00, average rate of exchange in 1978 and 1979.

The Mineral Industry of Belgium-Luxembourg

By William F. Keyes[1]

BELGIUM

Little improvement in the Belgium economy was in evidence during most of 1978, although by yearend a change for the better was noted, and the upturn continued through 1979. It was estimated that the economy grew in real terms about 2.5% in 1978 to a gross national product (GNP) of U.S. $96 billion[2] and 3.5% in 1979 to $103 billion. The value in U.S. currency was inflated by the declining value of the U.S. dollar. Unemployment, at about 7% each year, was high, but this was mitigated by generous unemployment benefits. Wages also were surpassed in Europe only by those paid in Sweden and the Netherlands. The Belgian minerals industry, consisting largely of the processing of imported minerals and metals was, like the economy, at a low ebb, except that steel production recovered slightly from the record low it reached in 1977.

The major event of the period 1978-1979 in the mineral and metal industries was the working out of agreements on restructuring of the Belgian steel industry by the Government, the operators, and the labor unions. Efforts to help the similarly ailing fuels industry included studies of in situ gasification, the closing of one petroleum refinery as uneconomic, and the continued investigation of uranium occurrences. In Luxembourg the steel industry participated in a restructuring similar to that of the Belgian industry and continued modernization and rationalization.

The Belgian-Luxembourg steel industry was of significant world importance. Processing of nonferrous ores was also of major significance, but all other mineral production and processing, including coal, was chiefly of domestic importance.

PRODUCTION

The industrial production index increased from 117 to 120, but the general index of the extractive industries declined from 63.5 in 1977 to 57.9 in 1978 (1970=100). Both sectors declined during that period, coal from 49.9 to 45.0 and other minerals from 117.8 to 110.9. In the metallurgical industries the picture was mixed: The steel production index rose from 89.2 to 100.4 in 1978, and continued to rise somewhat in 1979, but the nonferrous metals production index declined from 149.8 to 144.8 from 1977 to 1979.

Production of minerals and metals in Belgium in the period 1976-1979 is given in table 1.

Table 1.—Belgium: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978	1979
METALS				
Aluminum metal, secondary only	2,600	3,600	3,579	3,500
Cadmium, smelter	1,200	1,440	1,164	1,420
Copper:				
Blister:				
Primary[e]	14,000	13,000	9,000	9,200
Secondary[e]	58,000	48,600	46,900	47,800
Total	72,000	61,600	55,900	57,000
Refined, primary and secondary, including alloys	425,000	464,700	388,600	386,000
Iron and steel:				
Iron ore and concentrate thousand tons	63	47	43	--
Pig iron do.	9,877	8,924	10,260	10,800
Ferroalloys: Electric furnace ferromanganese do.	84	55	87	90
Steel:				
Crude do.	12,145	11,256	12,601	[e]13,442
Semimanufactures do.	9,588	9,387	10,518	NA
Lead metal:				
Primary	106,000	104,000	104,200	91,800
Secondary	15,524	18,796	20,840	24,300
Total	121,524	122,796	125,040	116,100
Selenium[e] kilograms	60,000	60,000	60,000	60,000
Tin metal:				
Primary	4,068	3,520	3,295	3,000
Secondary	1,992	1,484	1,901	NA
Total	6,060	5,004	5,196	NA
Zinc:				
Slab zinc:				
Primary	234,748	247,628	233,916	255,000
Secondary (remelted zinc)	6,500	10,600	6,600	5,000
Total	241,248	258,228	240,516	260,000
Zinc powder	42,420	43,632	32,904	30,000
Other, nonferrous:				
Precious metals, unworked, n.e.s.[3] thousand troy ounces	30,637	29,373	29,732	NA
Base metals, unspecified[4]	6,004	3,432	[e]2,576	NA
NONMETALS				
Cement, hydraulic thousand tons	7,504	7,764	7,576	7,600
Clays: Kaolin do.	120	120	120	120
Gypsum and anhydrite, calcined	219,708	167,436	183,492	190,000
Lime and dead-burned dolomite:				
Quicklime thousand tons	2,304	2,316	2,304	
Dead-burned dolomite do.	209	172	167	3,500
Nitrogen: N content of ammonia do.	539	584	492	540
Phosphates: Thomas slag, gross weight do.	972	841	858	NA
Sodium compounds:				
Sodium carbonate	351,456	441,444	427,440	NA
Sodium sulfate	310,000	250,000	250,000	250,000
Stone, sand and gravel:				
Calcareous:				
Dolomite thousand tons	2,685	2,524	3,489	NA
Limestone do.	24,156	29,076	27,048	NA
Marble:				
In blocks cubic meters	2,340	3,048	3,612	NA
Crushed and other	4,944	3,132	5,508	NA
Petit granite (Belgian bluestone):				
Quarried cubic meters	739,800	679,656	693,024	NA
Sawed do.	67,944	68,292	71,328	NA
Worked do.	9,336	9,612	11,856	NA
Crushed and other do.	626,916	577,080	554,160	NA
Porphyry, all types thousand tons	[r]6,288	5,726	5,374	NA
Quartz and quartzite	311,422	244,580	315,179	NA
Sandstone:				
Rough stone, including crushed thousand tons	2,267	2,494	2,303	NA
Paving and mosaic stone	894	2845	19,272	NA
Other	40,773			
Sand and gravel:				
Construction sand thousand tons	9,744	9,364	7,981	NA
Foundry sand do.	1,044	1,039	1,043	NA
Dredged sand do.	1,236	1,242	923	NA
Glass sand do.	1,620	1,661	1,602	NA
Other sand do.	2,244	1,956	1,915	NA
Gravel (dredged) do.	6,912	7,686	5,566	NA
Sulfur, byproduct:				
Elemental do.	35	88	110	110

See footnotes at end of table.

Table 1.—Belgium: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978	1979
NONMETALS —Continued				
Sulfur, byproduct —Continued				
Other forms .... thousand tons..	183	169	157	160
Total .... do....	218	257	267	270
MINERAL FUELS AND RELATED MATERIALS				
Carbon black[e]	2,000	2,000	2,000	2,000
Coal:				
Anthracite .... thousand tons..	1,126	796	628	NA
Bituminous .... do....	6,112	6,272	5,963	NA
Total .... do....	7,238	7,068	6,591	[2]6,132
Coke, all types .... do....	6,216	5,568	5,748	6,600
Fuel briquets, all kinds .... do....	166	126	125	NA
Gas:				
Manufactured .... million cubic feet..	[r]25,765	23,361	24,554	NA
Natural .... do....	1,186	1,362	858	830
Petroleum refinery products:				
Gasoline .... thousand 42-gallon barrels..	33,448	43,155	40,928	NA
Jet fuel .... do....	8,544	14,024	11,968	NA
Kerosine .... do....	302	1,008	12,192	NA
Distillate fuel oil .... do....	67,677	86,230	80,038	NA
Residual fuel oil .... do....	68,558	84,482	71,735	NA
Lubricants .... do....	707	714	616	NA
Other .... do....	25,634	26,038	19,040	NA
Refinery fuel and losses .... do....	8,195	13,079	13,086	NA
Total .... do....	213,065	268,730	249,603	NA

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed individually, Belgium produces a number of other metals for which only aggregate output figures are available. These aggregates are included under "Other nonferrous metals."

[2] Reported figure.

[3] Known to include gold and silver and may include platinum-group metals.

[4] Derived by subtracting aluminum data from a reported total for unspecified base metals.

TRADE

Belgium is overall the eighth-largest trading partner of the United States. The major part of minerals and metals trade between the two countries consisted of U.S. exports of coal, petroleum coke and lubricants, and nonferrous ores to Belgium, and U.S. imports of diamonds, semifabricated steel products, and aluminum and other base metals. The balance of trade in minerals favored Belgium: U.S. imports from Belgium were valued at $830 million, while U.S. exports to Belgium were $354 million in 1977.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite and concentrate	59	689	NA.
Oxide and hydroxide	194	185	Netherlands 55; Japan 47; France 13; Turkey 10.
Ash and residue containing aluminum....	2,385	5,475	West Germany 4,683.
Metal including alloys:			
Scrap	38,978	28,726	France 11,659; West Germany 9,773; Netherlands 5,489.
Unwrought	13,076	10,185	West Germany 6,318; France 3,256.
Semimanufactures	216,391	227,256	France 42,668; United States 41,680; West Germany 32,734.
Antimony:			
Ore and concentrate	10	--	
Metal including alloys, all forms	9	52	West Germany 50.
Beryllium metal including alloys, all forms kilograms..	--	590	NA.
Cadmium metal including alloys, all forms ..	945	735	West Germany 308; United States 198; France 153.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Chromium:			
Chromite	1,071	447	Netherlands 228; Italy 120; France 77.
Oxide, hydroxide, trioxide	30	50	NA.
Metal including alloys, all forms	59	422	West Germany 254; United Kingdom 81; Romania 58.
Copper:			
Ore and concentrate	1,539	3,443	Czechoslovakia 2,795; West Germany 325.
Matte	884	--	
Copper sulfate	9,376	12,359	Netherlands 3,857; West Germany 2,715; Denmark 2,537.
Ash and residue containing copper	2,700	1,479	United Kingdom 553; West Germany 487; Spain 286.
Metal including alloys:			
Scrap	16,573	19,912	West Germany 8,658; France 3,904; Netherlands 3,514.
Unwrought	327,850	313,376	France 106,025; West Germany 55,948; United Kingdom 34,749.
Semimanufactures	271,052	282,534	France 126,293; West Germany 62,192; Netherlands 18,305.
Gold:			
Waste and sweepings value, thousands	\$63	\$109	NA.
Metal, unworked or partly worked thousand troy ounces	^{r}1,010	894	West Germany 639; Switzerland 135.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	148	84	France 83.
Roasted pyrite do	170	153	West Germany 142.
Metal:			
Scrap do	501	532	West Germany 207; France 178; Netherlands 72.
Pig iron, including cast iron do	^{r}52	37	West Germany 15; France 12; Netherlands 8.
Sponge iron, powder, shot	401	351	West Germany 113; France 51.
Spiegeleisen	405	235	NA.
Ferroalloys:			
Ferromanganese thousand tons	50	30	France 11; West Germany 8; United States 6.
Other do	37	42	Italy 6; France 5; West Germany 3.
Steel, primary forms do	^{r}2,072	2,676	France 1,233; West Germany 659; Italy 189.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	3,936	4,172	West Germany 981; France 644; Netherlands 446.
Universals, plates, sheets do	^{r}5,154	5,239	France 1,203; West Germany 1,110; Netherlands 698.
Hoop and strip do	675	770	West Germany 242; France 187; Switzerland 59.
Rails and accessories do	67	81	Italy 21; France 19; United States 11.
Wire do	421	465	West Germany 88; France 70; United States 62; Netherlands 47.
Tubes, pipes, fittings do	^{r}281	357	West Germany 68; Algeria 67; Netherlands 48; France 33.
Castings and forgings, rough do	12	11	Netherlands 6; West Germany 3.
Total do	^{r}10,546	11,095	
Lead:			
Ore and concentrate	16	25	NA.
Oxides	6,707	5,778	Netherlands 2,241; West Germany 1,696; France 267.
Ash and residue containing lead	9,325	8,568	Netherlands 4,134; West Germany 2,337; France 1,968.
Metal including alloys:			
Scrap	12,698	15,653	France 12,694; Netherlands 1,601.
Unwrought	76,930	85,987	Netherlands 22,540; West Germany 21,899; France 12,890.
Semimanufactures	5,893	5,716	Netherlands 4,260; France 83; Hungary 76; Switzerland 75.
Magnesium metal including alloys:			
Scrap	387	368	United States 102; West Germany 40; France 34.
Unwrought and semimanufactures	73	145	West Germany 110.
Manganese:			
Ore and concentrate	9,888	11,324	United Kingdom 4,417; Netherlands 2,701; West Germany 1,992.
Metal including alloys, all forms	1	76	NA.
Mercury 76-pound flasks	1,259	1,633	NA.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Molybdenum:			
Ore and concentrate	4,338	5,872	West Germany 2,261; Sweden 921; Italy 654.
Metal including alloys, all forms	77	121	Netherlands 66; Sweden 38; West Germany 13.
Nickel:			
Ore and concentrate	--	1	NA.
Matte, speiss, similar materials	12	1	NA.
Metal including alloys:			
Scrap	1,309	1,220	West Germany 530; Netherlands 284; United Kingdom 76.
Unwrought	270	331	Poland 138; West Germany 102; Egypt 37.
Semimanufactures	2,291	1,902	Netherlands 45; U.S.S.R. 16.
Platinum-group metals including alloys, all forms troy ounces	102,746	117,668	West Germany 45,602; United States 37,689; Netherlands 12,750.
Selenium, elemental kilograms	^{r}166,500	157,200	West Germany 78,400; Netherlands 21,800; United States 18,400.
Silver metal including alloys thousand troy ounces	25,051	20,994	United Kingdom 7,297; West Germany 3,174; France 2,887.
Tin:			
Ore and concentrate	--	56	Portugal 35.
Oxides	^{r}1	--	
Metal including alloys:			
Scrap	98	149	NA.
Unwrought	2,615	2,417	France 1,177; Netherlands 248; West Germany 224.
Semimanufactures	39	71	Netherlands 25; Switzerland 5; United Kingdom 2.
Titanium:			
Ore and concentrate	31	3	NA.
Oxides	29,087	28,457	West Germany 8,345; France 5,752; United States 2,478.
Metal including alloys, all forms	109	164	Italy 35; France 29; West Germany 25.
Tungsten:			
Ore and concentrate	49	45	France 21; Netherlands 10; United Kingdom 8; United States 6.
Metal including alloys, all forms	230	215	West Germany 87; Netherlands 83; United Kingdom 21.
Uranium and titanium ores and concentrates	533	547	France 547.
Vanadium oxides	167	105	Japan 35; West Germany 30; United Kingdom 17.
Zinc:			
Ore and concentrate	27,585	11,676	France 6,612; West Germany 3,003; Netherlands 2,061.
Oxides	5,267	4,862	France 1,118; Hungary 1,040; West Germany 694.
Ash and residue containing zinc	56,533	42,685	France 12,742; West Germany 9,575.
Metal including alloys:			
Scrap	3,948	4,147	France 2,249; Netherlands 1,338.
Blue powder (dust)	16,585	18,405	West Germany 10,556; France 2,694; Netherlands 1,551.
Unwrought	188,824	187,102	West Germany 69,894; France 48,668; United States 19,968.
Semimanufactures	^{r}6,583	9,108	West Germany 5,086; Netherlands 2,035; France 560.
Other:			
Ores and concentrates:			
Of niobium, tantalum, vanadium, zirconium	62	51	NA.
Of precious metals kilograms	--	200	NA.
Of base metals, n.e.s	^{r}5	72	NA.
Ash and residue containing nonferrous metals	^{r}26,581	43,969	Netherlands 30,801; France 4,935; West Germany 4,389.
Waste and sweepings of precious metals value, thousands	$5,540	$7,421	United Kingdom $4,908; West Germany $2,093.
Oxides, hydroxides, peroxides of metals	2,335	2,486	Netherlands 1,007; West Germany 444; United States 241.
Metals including alloys, all forms:			
Metalloids:			
Tellurium and arsenic	1	24	West Germany 6; United States 5; France 4.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Other —Continued			
Metals including alloys, all forms —Continued			
Metalloids —Continued			
Other	^{r}127,114	119,636	Netherlands 102,652.
Alkali, alkaline earth, rare-earth metals	13	69	NA.
Pyrophoric alloys	--	1	NA.
Base metals including alloys, all forms, n.e.s	^{r}299	293	Austria 142; West Germany 59; Finland 21.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	21,415	245	NA.
Dust and powder of precious and semiprecious stones, natural and manufactured kilograms	1,108	958	United States 262; Israel 132; United Kingdom 82.
Grinding and polishing wheels and stones	3,111	2,381	France 1,375; West Germany 400; United Kingdom 222.
Asbestos	225	221	Spain 75; Netherlands 48.
Barite and witherite	315	408	NA.
Boron materials:			
Crude natural borates	10,980	9,503	Netherlands 4,459; West Germany 4,419.
Oxides and acid	103	423	West Germany 158; United States 82; Canada 36.
Bromine	--	138	NA.
Cement thousand tons	2,399	2,762	Netherlands 1,616; West Germany 367; France 271.
Chalk	54,129	64,813	Netherlands 12,630; West Germany 12,105; Saudi Arabia 9,571.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	7,845	8,273	France 4,541; West Germany 1,307; Italy 899.
Kaolin	6,187	3,175	Netherlands 1,782; West Germany 375; France 193.
Other	4,383	3,663	NA.
Products:			
Refractory (including nonclay brick)	^{r}86,306	96,215	France 51,283; West Germany 15,308; Italy 4,852.
Nonrefractory value, thousands	$40,172	$53,459	Netherlands $24,967; West Germany $12,576; France $7,224.
Cryolite and chiolite kilograms	500	15,700	NA.
Diamond:			
Gem:			
Unworked thousand carats	22,317	24,564	India 11,780; United Kingdom 8,755; Israel 1,304.
Worked do	3,143	3,077	United States 901; West Germany 345; Hong Kong 343.
Industrial:			
Unworked do	9,096	8,641	United States 2,697; Ireland 2,236; United Kingdom 1,593.
Worked do	^{r}11	9	Switzerland 2; United Kingdom 2; Canada 1; United States 1.
Diatomite and other infusorial earth	4,103	3,567	NA.
Feldspar, leucite, nepheline, nepheline syenite	6,975	8,543	Netherlands 8,489.
Fertilizer materials:			
Crude:			
Nitrogenous	13,723	9,816	Italy 4,286; West Germany 3,850; France 1,097.
Phosphatic	^{r}11,553	14,203	France 6,248; Netherlands 4,963; West Germany 1,833.
Potassic, K_2O content	^{r}63	138	NA.
Manufactured:			
Nitrogenous, N_2 content thousand tons	481	516	France 166; West Germany 116; India 21.
Phosphatic, P_2O_5 content do	265	280	France 134; West Germany 104.
Potassic, K_2O content do	245	283	France 67; Norway 47; Japan 41; Netherlands 23.
Other, including mixed do	1,431	1,641	France 867; West Germany 232; Venezuela 80.
Ammonia do	111	85	France 83.
Fluorspar	1,439	4,540	West Germany 4,074.
Graphite, natural	68	68	NA.
Gypsum and plasters	38,420	54,905	Netherlands 49,016; West Germany 3,664.
Lime thousand tons	616	590	Netherlands 505; France 6; Ivory Coast 3.
Magnesite	3,318	3,594	France 2,418; West Germany 541; Sweden 152.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Mica:			
Crude, including splittings and waste	115	94	NA.
Worked, including agglomerated splittings	1	2	NA.
Pigments, mineral, including processed iron oxides	7,894	9,055	France 5,679; Italy 1,291; West Germany 686.
Precious and semiprecious stones:			
Natural, except diamond:			
Unworked kilograms	(1)	(1)	NA.
Worked:			
Gem do.	318	398	West Germany 99; Switzerland 38; Denmark 23.
Industrial do.	15	(1)	NA.
Manufactured do.	4,441	299	United States 61; West Germany 40; Netherlands 5.
Pyrite, gross weight	412	53	NA.
Salt and brines	137,723	139,471	France 93,636; Nigeria 1,506.
Sodium and potassium compounds	^{r}36,110	43,656	Netherlands 9,340; France 7,547; West Germany 2,885.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous thousand tons	709	584	Netherlands 552; West Germany 18.
Slate	2,956	4,642	Netherlands 2,783; West Germany 1,615.
Other	35,104	18,908	NA.
Worked:			
Slate	866	979	West Germany 477; Netherlands 169.
Paving and flagstone	18,395	11,934	Netherlands 8,760; Japan 1,995; West Germany 684.
Other	11,346	10,251	Netherlands 3,107; West Germany 2,850; France 2,415.
Dolomite, chiefly refractory grade thousand tons	1,469	1,602	Netherlands 785; West Germany 615; France 40.
Gravel and crushed rock do.	10,615	12,284	Netherlands 3,646; France 3,754; West Germany 132.
Limestone (except dimension) do.	651	536	Netherlands 343; France 187.
Quartz and quartzite do.	10	10	West Germany 5; Netherlands 1; Austria 1.
Sand, excluding metal bearing do.	3,580	2,975	Netherlands 971; France 806; Italy 271.
Sulfur:			
Elemental, all forms	17,353	10,661	Netherlands 2,491; France 1,606; West Germany 1,292.
Sulfur dioxide	71	NA	
Sulfuric acid	116,981	125,624	France 102,179.
Talc, steatite, soapstone, pyrophyllite	19,857	18,286	West Germany 5,847; United Kingdom 2,979; Sweden 2,049.
Other:			
Crude:			
Lithium minerals	61	--	
Vermiculite, perlite, chlorite	912	1,134	NA.
Other thousand tons	261	152	Netherlands 128; France 18.
Slag, dross, and similar waste, not metal bearing do.	2,068	2,185	Netherlands 784; West Germany 781; France 527.
Oxides and hydroxides of magnesium, strontium, barium	600	194	NA.
Iodine and fluorine	127	8	NA.
Building materials of asphalt, asbestos, and fibercement, and unfired nonmetals, n.e.s thousand tons	372	1,370	Netherlands 435; United Kingdom 281; France 230.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	539	4,465	NA.
Carbon black and gas carbon:			
Carbon black	655	947	Netherlands 127; West Germany 99; Morocco 47.
Gas carbon	78	NA	
Coal and briquets:			
Anthracite and bituminous coal thousand tons	357	246	West Germany 92; France 90; Spain 18; Norway 11.
Briquets of anthracite and bituminous coal	9,682	25,622	France 19,199; West Germany 3,059; Spain 1,000.
Lignite and lignite briquets	59	8	NA.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Coke and semicoke thousand tons	150	196	France 111; United States 24; West Germany 23.
Gas, natural million cubic feet	[r]87,111	1,596	United States 1,505.
Hydrogen, argon, rare gases	31,799	39,981	France 25,908; West Germany 8,339; Netherlands 367.
Peat, including peat briquets and litter	595	1,984	NA.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	[r](1)	591	Netherlands 564.
Refinery products:			
Gasoline and white spirit do	[r]3,794	3,451	West Germany 1,151; Netherlands 568; United Kingdom 425.
Kerosine do	1,058	826	West Germany 251; United Kingdom 66; Netherlands 63.
Distillate fuel oil do	[r]2,603	2,148	West Germany 1,171; Denmark 272; United Kingdom 91.
Residual fuel oil do	[r]47,108	36,615	United Kingdom 9,820; Netherlands 5,700; West Germany 4,709.
Lubricants do	2,441	2,265	Netherlands 703; West Germany 270; Switzerland 137.
Other:			
Liquefied petroleum gas do	[r]2,906	2,628	Netherlands 1,055; United States 584; France 206.
Mineral jelly and wax do	[r]29	40	France 14; West Germany 5; Italy 3.
Nonlubricating oils, n.e.s. do	[r]56	67	Netherlands 30; Saudi Arabia 15; Lebanon 4; Syria 4.
Bitumen and other residues do	[r]1,236	1,296	Netherlands 537; Sweden 236; Norway 231.
Bituminous mixtures, n.e.s do	115	98	Netherlands 33; France 29; West Germany 13.
Pitch, pitch coke, petroleum coke do	[r]328	375	Netherlands 184; France 109; West Germany 79.
Unspecified do	93	68	West Germany 17; Netherlands 4; Denmark 3.
Total do	[r]61,767	49,877	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand tons	228	276	West Germany 99; Netherlands 90; France 38.

[r] Revised. NA Not available.

[1] Less than 1/2 unit.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate	17,406	32,867	West Germany 10,483; Netherlands 10,293; Guyana 9,001.
Oxide and hydroxide	22,284	21,834	West Germany 17,111; Netherlands 1,887; France 620.
Ash and residue containing aluminum	1,399	1,582	West Germany 1,356.
Metal including alloys:			
Scrap	14,161	15,351	France 4,470; West Germany 4,248; Netherlands 2,990.
Unwrought	238,410	266,834	Netherlands 131,222; France 38,215; West Germany 33,974.
Semimanufactures	73,259	75,662	West Germany 31,571; Netherlands 14,819; France 14,622.
Antimony:			
Ore and concentrate	6,823	5,178	Bolivia 3,310; Australia 838; Canada 499.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Antimony —Continued			
Metal including alloys, all forms	550	227	China, mainland, 150; France 66.
Arsenic trioxides, pentoxides, acids	34	--	
Beryllium metal including alloys, all forms kilograms	300	200	NA.
Cadmium metal including alloys, all forms	1,146	1,032	West Germany 163; Japan 158; Zaire 150.
Chromium:			
Chromite	3,891	2,309	Netherlands 1,126; Republic of South Africa 1,101.
Oxide and hydroxide	511	524	West Germany 390; Italy 43.
Metal including alloys, all forms	226	909	U.S.S.R. 767; France 25; United Kingdom 22.
Cobalt oxides and hydroxides kilograms	59,000	66,000	West Germany 33,000; United States 15,000; France 6,000.
Copper:			
Ore and concentrate	21,283	5,485	Australia 2,105; Bolivia 1,892.
Matte	223,311	--	
Copper sulfate	93	1,075	France 543; Netherlands 238.
Ash and residue containing copper	^{r}24,819	24,601	United States 7,657; France 5,232; Morocco 2,116.
Metal including alloys:			
Scrap	69,660	64,993	France 24,416; Netherlands 16,188; United States 5,949.
Unwrought	361,770	560,151	Zaire 304,364; Republic of South Africa 53,669; Chile 38,404.
Semimanufactures	38,621	50,381	West Germany 31,628; France 4,898; Netherlands 3,635.
Gold:			
Waste and sweepings value, thousands	$918	$919	United States $441; Netherlands $375.
Metal, worked and partly worked thousand troy ounces	^{r}2,449	1,687	West Germany 828; Switzerland 487; Netherlands 24.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	21,522	24,243	France 8,999; Sweden 5,398; Brazil 2,316.
Roasted pyrite do	251	215	West Germany 101; France 94.
Metal:			
Scrap do	493	980	West Germany 367; Netherlands 289; France 159.
Pig iron, including cast iron do	167	119	France 41; Brazil 30; West Germany 27.
Sponge iron, powder, shot	5,162	4,988	France 1,756; West Germany 1,017; Sweden 610.
Spiegeleisen	366	407	NA.
Ferroalloys thousand tons	155	164	Norway 49; France 48; West Germany 21.
Steel, primary forms do	1,029	1,076	Netherlands 355; West Germany 175; Poland 99.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	940	875	France 291; West Germany 186; Netherlands 92.
Universals, plates, sheets do	^{r}740	685	Netherlands 161; West Germany 143; France 136.
Hoop and strip do	151	151	France 92; West Germany 34; Netherlands 4.
Rails and accessories do	32	38	France 24; West Germany 12.
Wire do	58	56	West Germany 31; France 10; Netherlands 9.
Tubes, pipes, fittings do	^{r}212	209	West Germany 67; France 50; Netherlands 43.
Castings and forgings, rough do	41	38	West Germany 13; France 11; Netherlands 4.
Total do	^{r}2,174	2,052	
Lead:			
Ore and concentrate	52,912	74,541	Australia 18,656; Greece 15,888; Peru 10,617.
Ash and residue containing lead	64,674	42,919	United States 16,834; United Kingdom 6,795; Spain 3,278.
Oxides	1,751	1,364	France 917; West Germany 236.
Metal including alloys:			
Scrap	12,682	14,593	Netherlands 8,712; France 2,326; West Germany 2,116.
Unwrought	54,700	56,394	France 16,248; West Germany 3,629; Netherlands 2,318.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Lead —Continued			
Metal including alloys —Continued			
Semimanufactures	1,679	2,584	West Germany 1,361; Netherlands 643; France 253.
Magnesium metal including alloys:			
Scrap	122	110	France 55.
Unwrought	1,200	1,702	France 454; Netherlands 382; Italy 215.
Semimanufactures	224	464	United Kingdom 177; United States 123; West Germany 70.
Manganese:			
Ore and concentrate	206,726	252,842	Republic of South Africa 83,480; Congo 42,317; Ghana 41,436.
Oxides	1,946	2,252	Greece 1,103; Ireland 660; West Germany 193.
Metal	529	522	Republic of South Africa 177; Mozambique 92; Norway 65.
Mercury 76-pound flasks	2,750	2,785	Italy 1,801; Finland 232; Netherlands 229; Algeria 203.
Molybdenum:			
Ore and concentrate	12,517	13,381	Canada 5,233; United States 3,889; Chile 3,278.
Metal including alloys, all forms	118	332	United Kingdom 201; Netherlands 103; West Germany 11.
Nickel:			
Ore and concentrate	73	--	
Matte, speiss, similar materials	267	401	Sweden 246; Netherlands 146.
Metal including alloys:			
Scrap	1,376	1,072	France 349; United States 232; Netherlands 225.
Unwrought	1,591	3,066	Republic of South Africa 753; Netherlands 438; United Kingdom 423.
Semimanufactures	2,702	2,034	West Germany 1,097; United Kingdom 345; France 152.
Platinum-group metals including alloys, all forms troy ounces	96,825	88,506	United Kingdom 47,957; West Germany 11,517; Italy 8,428.
Selenium, elemental kilograms	12,700	6,500	Netherlands 2,500; West Germany 2,100.
Silver metal including alloys thousand troy ounces	40,749	28,482	Netherlands 11,454; United States 10,272; West Germany 1,252.
Tin:			
Ore and concentrate	5,299	4,718	Zaire 3,404; Rwanda 898; Singapore 101.
Oxides	42	--	
Metal including alloys:			
Scrap	134	131	Netherlands 90; United States 21; Iraq 10.
Unwrought	2,152	2,233	Malaysia 949; Zaire 466; Netherlands 241.
Semimanufactures	343	343	Netherlands 153; West Germany 103; France 55.
Titanium:			
Ore and concentrate	67,244	36,979	Canada 35,776.
Oxides	^{r}11,032	12,674	West Germany 4,211; United States 2,319; United Kingdom 1,930.
Metal including alloys, all forms	607	1,462	United States 1,068; West Germany 55; United Kingdom 37.
Tungsten:			
Ore and concentrate	^{r}98	--	
Metal including alloys, all forms	237	199	Netherlands 105; West Germany 55; France 17.
Uranium metal including alloys, all forms value, thousands	^{r}$2,048	$7,572	France $6,940.
Vanadium oxide	643	1,771	Republic of South Africa 1,029; Netherlands 479; West Germany 54.
Zinc:			
Ore and concentrate	544,917	532,471	Canada 280,245; Ireland 49,588; West Germany 41,376.
Oxide and peroxide	8,691	7,308	France 2,819; Netherlands 1,680; United Kingdom 1,066.
Ash and residue containing zinc	41,988	57,020	West Germany 21,255; France 19,280; Netherlands 5,315.
Metal including alloys:			
Scrap	9,448	5,551	Netherlands 2,456; West Germany 763; France 715.
Blue powder	658	936	West Germany 443; Netherlands 342; France 103.
Unwrought	28,854	24,928	Netherlands 7,217; Canada 6,715; France 3,147.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Zinc —Continued			
Metal including alloys —Continued			
Semimanufactures	[r]10,870	19,207	France 18,252; West Germany 233; Netherlands 71.
Other:			
Ores and concentrates:			
Of niobium, tantalum, vanadium, zirconium	3,911	3,681	Canada 1,812; Australia 585; West Germany 550.
Of precious metals	143	55	NA.
Of base metals, n.e.s	[r]7,489	67,751	Canada 55,485; Denmark 509; Australia 379.
Ash and residue containing nonferrous metals n.e.s	51,473	68,489	West Germany 29,123; Malaysia 6,327; Republic of South Africa 3,411.
Waste and sweepings of precious metals value, thousands	$8,722	$8,849	United States $3,284; United Kingdom $2,064; Netherlands $1,490.
Oxides, hydroxides, peroxides, of metals	[r]1,390	1,431	West Germany 741; United Kingdom 123; United States 107.
Metals including alloys, all forms:			
Metalloids:			
Tellurium and arsenic	62	73	Sweden 67; United States 5.
Other	5,654	8,538	France 6,309; West Germany 614; United States 126.
Alkali, alkaline earth, rare-earth metals	[r]141	125	France 68; West Germany 21.
Pyrophoric alloys	[r]2	1	NA.
Base metals including alloys, all forms	133	216	United States 159; West Germany 29.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	80,039	57,258	West Germany 55,733.
Dust and powder of precious and semiprecious stones, natural and manufactured, including diamond kilograms	3,825	3,467	Ireland 1,635; United States 1,045.
Grinding and polishing wheels and stones	2,874	2,818	West Germany 801; Austria 508; Netherlands 333.
Asbestos	54,219	51,037	Canada 19,936; U.S.S.R. 14,344; Republic of South Africa 6,248.
Barite and witherite	8,318	8,292	France 5,947; West Germany 2,207.
Boron materials:			
Crude natural borates	60,558	31,956	Turkey 23,385; Netherlands 3,333; France 1,961.
Oxide and acid	1,877	2,164	France 1,518.
Bromine	44	249	United States 152; Netherlands 83.
Cement	164,667	357,398	West Germany 166,201; Netherlands 129,441; France 21,331.
Chalk	114,434	111,321	France 88,796.
Clays and clay products:			
Crude:			
Bentonite	26,556	28,628	United States 8,703; Netherlands 8,280; Greece 5,278.
Kaolin	275,973	289,598	West Germany 90,561; United Kingdom 78,750; Netherlands 67,832.
Other	216,638	230,722	West Germany 94,528; France 11,784; United States 8,314.
Products:			
Refractory (including nonclay brick)	[r]138,167	145,084	West Germany 84,294; France 15,671; United Kingdom 7,114.
Nonrefractory value, thousands	$116,218	$141,377	West Germany $46,511; Italy $37,662; Netherlands $21,996.
Cryolite and chiolite	87	83	Denmark 81.
Diamond (except powder):			
Gem:			
Unworked thousand carats	28,876	26,190	United Kingdom 20,865.
Worked do	2,388	2,525	India 1,169; Israel 251; U.S.S.R. 218; United Kingdom 213.
Industrial:			
Unworked do	9,485	10,181	Ireland 2,834; United States 2,745; United Kingdom 1,611.
Worked do	8	2	Switzerland 1.
Diatomite and other infusorial earth	7,747	9,607	France 4,724; Spain 2,052; Denmark 1,655.
Feldspar, leucite, nepheline syenite	70,659	64,404	France 27,405; Norway 21,139; Canada 6,045.
Fertilizer materials:			
Crude:			
Nitrogenous	20,683	21,026	Chile 19,804.
Phosphatic thousand tons	1,926	1,941	Morocco 1,225; United States 314; Netherlands 99.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Fertilizer materials —Continued			
Crude —Continued			
Potassic, K_2O content	9,520	8,419	France 4,561; West Germany 3,659.
Manufactured:			
Nitrogenous, N_2 content	149,974	151,472	West Germany 50,355; Netherlands 31,216; France 30,370.
Phosphatic, P_2O_5 content	77,203	90,037	United States 48,890; Mexico 20,885; Netherlands 11,889.
Potassic, K_2O content	549,618	577,387	West Germany 324,197; France 80,221; U.S.S.R. 41,867.
Other, including mixed	347,162	4[illegible]1,[illegible]84	United States 185,349; West Germany 118,114; France 87,106.
Ammonia	1,690	2,368	NA.
Fluorspar	14,855	9,953	France 6,320; West Germany 1,376; United Kingdom 127.
Graphite, natural	891	3,959	Sweden 3,104; West Germany 254; Madagascar 246.
Gypsum and plasters	508,709	513,081	France 469,687.
Lime	134,503	146,887	France 138,008.
Magnesite	25,252	24,268	Greece 7,684; Italy 3,863; United Kingdom 3,096; Austria 2,435.
Mica:			
Crude, including splittings and waste	4,116	3,630	India 1,694; Madagascar 721; United Kingdom 498; France 319.
Worked including agglomerated splittings	50	36	Switzerland 14; France 7.
Pigments, mineral, including processed iron oxides	7,911	6,903	West Germany 5,798; Austria 105; United Kingdom 98.
Precious and semiprecious stones, except diamond:			
Natural:			
Unworked kilograms	(1)	(1)	NA.
Worked:			
Gem do	2,502	1,848	West Germany 272; Netherlands 61; India 41.
Industrial do	14	53	NA.
Manufactured do	1,319	1,781	United States 191; Ireland 23.
Pyrite, gross weight	214,322	202,917	Spain 201,945.
Salt and brines thousand tons	907	805	Netherlands 465; West Germany 307; France 29.
Sodium and potassium compounds, n.e.s	^{r}5,647	10,957	West Germany 2,740; France 2,497; Poland 1,716.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	143,620	115,579	France 51,588; Portugal 16,257; India 7,265; Poland 6,593.
Worked	89,962	100,819	France 28,962; Italy 26,562; West Germany 9,802.
Dolomite, chiefly refractory grade	56,201	50,665	France 26,999; West Germany 21,372.
Gravel and crushed rock thousand tons	6,157	7,069	Netherlands 3,416; United Kingdom 1,431; West Germany 1,389.
Limestone (except dimension)	226,912	323,234	United Kingdom 274,200.
Quartz and quartzite	138,398	141,744	West Germany 106,547; Norway 16,452; France 13,196.
Sand, excluding metal bearing thousand tons	10,104	9,934	Netherlands 8,443; West Germany 191.
Sulfur:			
Elemental, all forms	452,142	483,809	United States 264,136; France 62,976; Netherlands 60,830.
Sulfur dioxide	10,183	NA	
Sulfuric acid	253,122	268,975	West Germany 140,805; France 67,004; Netherlands 45,314.
Talc, steatite, soapstone, pyrophyllite	35,579	22,759	United States 6,455; France 5,647; Australia 4,460.
Other:			
Crude:			
Lithium minerals	297		
Vermiculite, perlite, chlorite	47,633	52,981	U.S.S.R. 24,002; Greece 20,129; Mozambique 2,319.
Other thousand tons	466	1,374	France 1,142; Spain 112; Netherlands 50.
Slag, dross, and similar waste, not metal bearing do	1,100	1,237	France 1,143; Netherlands 37; West Germany 15.
Oxides and hydroxides of magnesium, strontium, barium	1,501	1,356	West Germany 448; United Kingdom 367; East Germany 157.
Iodine and fluorine	140	132	Chile 115.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s thousand tons	503	876	West Germany 373; Netherlands 210; France 71.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	127,525	121,669	France 116,680; West Germany 1,686.
Carbon black and gas carbon:			
Carbon black	31,128	33,802	West Germany 12,864; Netherlands 10,968; France 4,557.
Gas carbon	2,239	NA	
Coal and briquets:			
Anthracite and bituminous coal thousand tons	6,935	7,659	West Germany 4,348; United States 881; Republic of South Africa 676.
Briquets of anthracite and bituminous coal do.	141	126	West Germany 100.
Lignite and lignite briquets do.	57	55	West Germany 53.
Coke and semicoke do.	2,113	2,654	West Germany 2,105.
Gas, natural million cubic feet	419,366	410,185	Netherlands 361,554.
Hydrogen, argon, rare gases	5,458	8,263	Netherlands 6,747; United States 347; West Germany 99.
Peat, including peat briquets and litter	145,869	142,855	West Germany 75,859; Netherlands 44,270.
Petroleum:			
Crude and partly refined:			
Crude thousand 42-gallon barrels	^{r}255,489	224,809	Saudi Arabia 90,657; Iran 51,975; United Arab Emirates 16,846.
Partly refined do.	^{r}630	432	Spain 98; United Kingdom 63; Algeria 62; Cuba 58.
Refinery products:			
Gasoline and white spirit do.	887	944	Netherlands 653; United Kingdom 103; West Germany 17.
Kerosine do.	74	18	Netherlands 11; France 6.
Distillate fuel oil do.	^{r}1,245	2,066	Netherlands 1,267; U.S.S.R. 297.
Residual fuel oil do.	^{r}17,593	30,824	Saudi Arabia 10,933; Netherlands 9,244; U.S.S.R. 2,692; France 2,528.
Lubricating oil and grease do.	2,782	2,721	Netherlands 893; France 860; Italy 418; United States 150.
Other:			
Liquefied petroleum gas do.	4,840	4,735	Netherlands 3,517; West Germany 273; Saudi Arabia 196.
Mineral jelly and wax do.	^{r}140	145	West Germany 8; France 4; United Kingdom 3.
Nonlubricating oil, n.e.s do.	^{r}620	735	West Germany 251; United States 180; Netherlands 155.
Bitumen and other residues do.	^{r}584	563	France 290; Netherlands 207.
Bituminous mixtures, n.e.s do.	170	205	Netherlands 107; France 58; West Germany 28.
Pitch, pitch coke, petroleum coke do.	^{r}402	476	United States 331; United Kingdom 64; West Germany 44.
Unspecified do.	^{r}2	14	United Kingdom 9; Netherlands 3; France 1.
Total do.	^{r}29,289	43,446	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	113,365	153,155	Netherlands 51,502; France 18,813; West Germany 18,170.

^{r}Revised. NA Not available.

[1] Less than 1/2 unit.

COMMODITY REVIEW

Metals.—*Cobalt.*—In 1978, Metallurgie Hoboken-Overpelt SA brought an expanded plant into operation for the production of cobalt oxides at Olen, but the shortage of supplies from Zaire, the former Belgian Congo, caused it to continue operating well below capacity. A start was made by the company on the erection of an ultrafine-cobalt-powder plant at Laurinburg, N.C. After June 1979, that portion of Zaire cobalt destined for the United States and Japan was routed there directly, without the repackaging formerly done at Olen. The 20% of Zaire cobalt refined at Olen was not affected.

Iron and Steel.—Belgium's last iron ore mine, between Halanzy and Musson on the French-Luxembourg border, which was operated by Metallurgique & Miniére de Rodange-Athus, was closed permanently at the end of November 1978. Production had declined to less than 50,000 tons per year.

The ailing Belgian steel industry was in a turmoil during the 2 years, after suffering heavy losses for 3 previous years. Production, although increasing, was only somewhat over 12 million tons in 1978 and 13 million tons in 1979, that is, only about 70% of capacity.

In May 1978, a tripartite conference of Government, industry, and labor representatives agreed on the basic form of reorganization of the industry. The chief elements included minority state equity in the steel firms; encouragement of closer ties with neighboring country steelmakers; state-controlled investment in modernization but not in new capacity; elimination of 8,500 jobs, with expensive Government-subsidized workers' benefits; and further extension of existing credit lines to the firms.

In the following November, lengthy discussions pursuant to the tripartite conference resulted in general agreement on a plan for restructuring the industry. The plan, called the "Claes Plan" after the Minister of Economic Affairs, envisaged the reorganization of the Belgian steel industry into three cores: (1) ARBED, including plants in Luxembourg and the Saar, and ARBED's subsidiary Sidmar, near Ghent, Flanders; Charleroi, consisting of the Triangle plants of three steelmakers, Hainaut-Sambre (HS), Thy-Marcinelle et Monceau (TMM), and Laminoirs du Ruau; and the Marchienne plant, formerly belonging to Cockerill; (2) Cockerill itself around Liege; and (3) the smaller independent steelmakers, Usines Gustave Boel SA, SA Fabrique de Fer de Charleroi, and SA Forges de Clabecq. Cockerill, which was seeking an alliance with Estel, the Dutch-German steelmaker, was assured, as were the independents, that its capacity would not suffer vis-a-vis the ARBED giant.

The Government (50% national, 50% regional) would take a large equity in HS (30.9%), TMM (42.3%), and Cockerill (28.9%), as well as in Sidmar, and a more limited participation in Clabecq. Additional participation in Cockerill would be 19.3% held by the Société General de Belgique and Fibelpar (including Cobepa, Bruxelles-Lambert, and Financiere du Ruau) and 51.8% held by small shareholders. In HS, 20.6% would be held by Financiere du Ruau and 48.5% by others. Some 28.2% of TMM would be held by Financiere du Ruau and 29.5% by others. The State would also assume at least two-thirds of the firms' debts. Estimates were that the annual cost to the Government would be about BF4.5 billion or roughly US$150 million. The Government will be represented on the firms' boards of directors on a 50-50 basis, half being through the Société Nationale d'Investissements and the other (regional) half through the Société Regionale d'Investissements.

New investments and disinvestments were to be coordinated by a planning section of a National Commission for Planning and Control (CNPC), with national Government and private sector representation. The planning section would define investment priorities and restructuring, promote common purchasing, and increase productivity, all implying decreased production and employment.

In January 1978, a BF44 billion (US$1.5 billion) program of investments was approved by the CNPC; all investments were to be financed 50-50 by the Government and industry investors (banks and holding companies). Total capacity of the industry would be increased to some 20 million tons per year, from the present level of 17 million tons; misgivings were voiced about this increase in a potentially declining market. However, potential increases in productivity would hopefully range from 22% in nonflat products (287 tons per year per worker to 350 tons) to 28% in rolled products (430 tons to 550 tons).

Nearly 5,000 workers and 1,850 salaried employees were to be separated in the entire steel industry, about two-thirds at Cockerill, but a fund would be created, on the basis of BF500,000 per job lost, to assist workers to convert to new employment. Since the funds would be spent largely in the French-speaking Walloon region, where the bulk of the steel industry is located, the cooperation of Flemish (Dutch speaking) regions was assured by including the textile and shipbuilding sectors in the fund.

Lead-Zinc.—An environmental problem came to public notice in 1978 at the Hoboken copper-lead operations of Metallurgie Hoboken-Overpelt SA, near Antwerp, when cases of lead poisoning were discovered among Hoboken schoolchildren. The mayor of Hoboken threatened to close the plant but relented later; the company responded by detailing the antipollution measures it has taken since 1973, amounting to $1.5 million annually since then, and reaching $4 million by 1979.

Annual zinc production was reduced to about 240,000 tons, a decrease of 15%, in response to indications from the International Lead and Zinc Study Group that demand was falling behind production; lead production remained stable at 124,000 tons. After suffering losses in 1977, two of Belgium's three electrolytic zinc producers received some relief as prices rose late in 1978. Worst hit by the depression in metal prices was the largest producer, Ste. des Mines et Fonderies de Zinc de la Vieille Montagne SA, with a plant (170,000 tons per year capacity) at Balen, which had few other products to depend on. The third-largest producer, Ste. de Prayon, et Ehein, near Liege (60,000 tons per year), was also a producer of chemicals. The second-largest producer, Hoboken-Overpelt, with a zinc plant at Overpelt (100,000 tons per year), continued in the black, owing largely to its production of copper and other metals, but a reduction of the work force at Overpelt was necessary.

During 1979, producers continued to announce production cuts in response to unprofitable prices. Vieille Montagne cut its production rate by about 20,000 tons per year at the end of 1979, and Prayon, after announcing a 15% cutback, shut down for the entire month of October.

Minor Metals.—Metallurgie Hoboken-Overpelt was constructing a new plant to recover indium and tellurium, as well as antimony oxide, from lead refinery byproducts. The new unit was to employ about 30 persons.

Molybdenum.—Continued supply of molybdenum to the European market from Noranda in Canada and Codelco in Chile was assured when the labor contract was extended, with a small increase in wages, at the Ghent plant of Sodacem SA. The plant roasts concentrates with a content of 5,000 tons per month of molybdenum.

Nonmetals.—*Barite.*—Belgium, although an important producer and exporter of nonmetallic minerals, such as sand and gravel, has not produced barite since before World War II, when the Fleurus mine was operated near Charleroi. During 1978, an American-controlled firm, NL-Baroid Minerals Inc., acquired a barite property and was planning to commence operations early in 1979.

Mineral Fuels.—*Coal.*—After preliminary testing, drilling began on July 1, 1978, on a 1,000-meter-deep in situ coal gasification site at Thulin, west of Mons; the work was a cooperative project financed by the Belgian Institut National des Industries Extractives, at Liege, a division of the Mines Administration (51%) and Kernforschungsanlagen Julich GmbH (49%) of Federal Republic of Germany. The project, interesting because of its great depth, was part of the Government's plan to maintain the Belgian coal mining industry, and particularly to foster utilization of reserves not currently minable. These reserves reportedly comprise some 2 billion tons of bituminous coal at a depth of 1,000 to 2,000 meters in the Center and Borinage coalfields around Mons, and over 20 billion tons north of the Kempen (Campine) field in the northeast Belgian province of Limburg. A BF200 million (US$7 million) installation to test in situ gasification was decided on late in 1979 and was to begin operations at Hensies nearby late in 1981.

Another move to help the coal industry was the agreement reached late in 1978 between Belgian coal and steel producers under which the steel producers will purchase all coking coal produced by Kempense Steenkolenmijnen, the Limburg producer, at least until 1990. The agreement will be at a price to be reviewed twice a year by the Government; the initial price was BF1,934 (about US$60) per ton.

Natural Gas.—A contract to construct the liquefied natural gas (LNG) terminal at Zeebrugge was awarded in 1978 by Distrigas SA and its consulting engineers, Tractebel Zeebrugge, to Pullman Kellogg Ltd., London, covering engineering, procurement, and advisory services. The terminal, with a capacity of 600 million cubic feet per day (6.2 billion cubic meters per year) will receive 5 billion cubic meters per year from an Arzew, Algeria, facility, which is also being constructed by Pullman Kellogg.

Petroleum.—The unprofitable Antwerp refinery, Raffinerie Belge des Petroles SA (RBP), also known as Belgisch Petroleum Raffinaderij NV, with distillation capacity of about 100,000 barrels per day, was closed by the controlling company, Occidental Petroleum Inc. of the United States, in September 1978. The action was followed by a 3-week strike by all petroleum workers in Belgium, in an attempt to save the jobs of the 256 workers. The strike was settled with increased benefits and a preferential hiring concession in the industry as a whole for the jobless. Management was particularly chary of guaranteeing displaced workers employment elsewhere in the depressed industry, which the union interpreted as being required under the 1959-60 petroleum sector agreement.

Seven Belgian refineries were active at the end of 1979, although at only about 65% of capacity, after closure of RBP. These had an approximate total distilling capacity of 1 million barrels per day. The largest, with one-third of the industry capacity, was Société Industrielle Belge des Petroles SA, at Antwerp, controlled 50-50 by BP and Petrofina; the SA Esso NV refinery at Antwerp had a capacity of about 225,000 barrels per day. Other large refineries were Texaco Belgium at Ghent (180,000), SA Chevron Belgium NB at Feluy (140,000), and the Albatros BNV refinery at Antwerp (100,000). Two small refineries completed the roster. Domestic consumption in Belgium was only about one-half the total capacity of the remaining plants, and the outlook for increased exports was bleak.

Uranium.—Under the uranium exploration project financed by the European Economic Community (EEC), Union Miniere, acting for the Belgian Mines Administration, was awarded BF20 million in 1979 for the examination of radioactive anomalies south of the Sambre-Meuse depression and in a 10-kilometer-wide strip north of it. Preliminary prospecting and soil sampling were planned. Total cost of the project was estimated at BF36.6 million, of which the EEC contribution was 55%; Union Miniere was contributing 10% and the Belgian Government the remainder.

Northwest of Mons, values of uranium as high as 80 parts per million have been found in the transition beds between Dinantian and Namurian sediments, in a canal cut between Blaton and Nimy. In a quarry near Cuesmes, south of Mons, analyses as high as 53 parts per million were encountered in the Maastricht formation.[3]

LUXEMBOURG

Acieries Reunies de Burbach-Eich-Dudelange SA (ARBED) acquired 25.09% of Metallurgique et Miniere de Rodange-Athus SA (MMRA) in 1978, in a move to salvage the latter, a 1-million-ton-per-year producer. This was in line with the interim settlement announced in 1977 by the Belgian Government, which closed almost all the Athus plant on the Belgian side of the border and reduced the labor force at Rodange in Luxembourg. A new MMRA company was now set up, with the non-ARBED capital (Lux F1.275 billion[4]). The new firm is held by Cockerill and Ruau (20% each); the Luxembourg Government's Société Nationale de Credit a l'Industrie, the Cie. Bruxelles-Lambert, and Luxembourg banks (15.69% each); and the Belgian Government's Société Belge Industrielle (7.84%). MMRA's production program was to be integrated into ARBED's nearby Differdange works.

The McKinsey report on the Belgium-Luxembourg steel industry classified ARBED's installations as Class I (viable), Class II (doubtfully viable), and Class III (not viable). Among the Class I installations were Esch-Belval's A, B, and (the new) C blast furnaces, the two sinter plants, and the steelmaking plant along with the Differdange steelmaking plant. Class II installations included the Differdange blast furnace and sinter plant and the Esch-Schifflange steelmaking plant. The entire Dudelange plant was classed intermediate between Classes II and III, and the Rodange plant (formerly MMRA) was put in Class III.

ARBED's plans for modernizing and rationalizing its production, announced in 1977, were detailed in its semiannual report in October 1978. A 4-year Lux F18.5 billion (about US$600 billion) investment program would include improvements at all four major production sites. At Esch-Belval (where the new 4,000-ton-per-day blast furnace was inaugurated in November 1979), Lux F9.5 billion would go chiefly for new torpedo ladles to transport hot metal to Differdange and Esch-Schifflange, for a continuous bloom casting strand and a new 50,000-ton-per-month medium mill. At Esch-Schifflange, two new continuous bloom casting strands, rolling mill improvements, and melting shop improvements would cost Lux F4.1 billion; Lux F1.2 billion would enlarge capacity of the Grey section mill to 7,500 tons per month, and increase melting shop capacity at Differdange to 7,500 tons per day. Finally, at the Dudelange flat products works, about Lux F4 billion would extend cold rolling strip production. A loan of Lux F4 billion was granted late in 1979 by the European Coal and Steel Community to aid the improvements at the Esch-Belval, Esch-Schifflange, and Dudelange works.

ARBED managed to improve its steelmaking productivity during 1978 by 6%

from 6.9 to 6.5 man hours per ton, largely through a 17% cut in labor, improving its position but not yet eliminating its losses; the company has been operating in the red since 1974. In 1978, losses were Lux F1.9 billion, which it hoped to cut to Lux F500 million in 1979.

Only one Luxembourg mine was operated by ARBED during 1978 (plus three nearby in France). This was the underground Differdange mine, which produced 566,700 tons, compared with almost double that the year before in the same mine.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Values have been converted from Belgian francs (BF) at the average rate of BF31.0=US$1.00 for 1978 and BF29.5=US$1.00 for 1979.

[3] Annales des Mines de Belgique. No. 5, May 1977, p. 251.

[4] The Luxembourg franc (Lux F) is equal in value to the Belgian franc.

Table 4.—Luxembourg: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[p]
METALS				
Iron and steel:				
Iron ore and concentrate	2,079	1,537	835	636
Pig iron (including blast furnace ferroalloys)	3,756	3,568	3,721	3,802
Steel:				
Crude	4,566	4,329	4,790	4,949
Semimanufactures	3,592	3,468	3,800	3,931
NONMETALS				
Cement, hydraulic	299	291	311	[e]360
Gypsum and anhydrite, crude ......tons	[r]1,690	2,693	990	[e]900
Phosphates: Thomas slag, gross weight	733	713	771	NA
Sand and gravel:				
Foundry sand ......tons	1,500	4,942	2,771	1,400
Other sand, except glass sand	729	638	615	747
Gravel	208	183	213	229
Stone:				
Construction:				
Crushed ......thousand cubic meters	776	778	715	NA
Dimension:				
Rough cut ......do	7	6	7	4
Facing ......thousand square meters	1	5	3	3
Finished ......cubic meters	86	6	72	NA
Flagstone:				
Polished ......square meters	6	5	4	NA
Rough ......tons	1	1	1	NA
Paving stone ......thousand pieces	6	18	14	NA
Slate slabs ......do	1,743	1,383	1,363	1,171
Industrial:				
Dolomite	387	407	271	294
Limestone ......tons	NA	NA	169,036	140,950
Quartz, quartzite, glass sand ......do	18,115	9,940	20,550	79,600
MINERAL FUELS AND RELATED MATERIALS				
Manufactured gas: Blast furnace gas (0.026 teracalorie per million cubic feet) ......million cubic feet	264,808	[e]247,000	[e]260,000	NA

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, Luxembourg also produces refractory clays and manufactured phosphatic fertilizers other than Thomas slag, but data are not published and information is inadequate to make reliable estimates of output levels.

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The Mineral Industry of Bolivia

By Orlando Martino[1]

The downtrend in the rate of economic growth experienced by Bolivia in 1977 continued in 1978 and 1979, which had growth rates of 3.1% and 2.0%, respectively, compared with the high rate of 6.4% in 1976. The performance of the economy has fallen below the 7% growth rate targeted in the 5-year development plan that ends in 1980. The gross domestic product (GDP) grew to the equivalent[2] of $4.2 billion in current dollars in 1978 and to $4.9 billion in 1979.

Bolivia's mining industry contributed 7.1% of the country's GDP in 1978; its share has been declining since 1970 when the contribution was 9.2%. In 1978, the mining sector's contributions represented 23% of the Government's revenues. Bolivia's economy remained dominated by its export-oriented mineral industry, which was responsible for over 70% of the country's foreign exchange earnings. Bolivia's mineral production and exports continued to decline in most cases in 1978 and 1979, but rising world prices especially in silver and tin offset decreased output.

The value of exports of mineral commodities, not including petroleum and natural gas, increased 5% in 1978 to $516 million and 9% in 1979 to $565 million. Bolivia exported gasoline in 1979 but ceased to export crude petroleum in late 1978 because of domestic needs. As a result, the value of petroleum exports continued to decline, decreasing 37% in 1978 and 13% in 1979.

In 1978, a major milestone was reached in Bolivia's mineral history when more than 50% of the country's tin production was processed into refined tin. Since the revolution of the early 1950's, Bolivia had sought to install and expand its tin smelter capacity in order to gain the economic benefits of exporting refined tin instead of only tin ore and concentrate. In 1978, the Empresa Nacional de Fundiciones (ENAF), the major State-owned smelter, produced almost 16,000 tons of refined tin compared with 6,800 tons in 1971, its first year of operation.

In late 1979, Bolivia and the World Bank were in consultation regarding a multiyear assistance program. The proposed program would provide financing for the state mining company, Corporacíon Minera de Bolivia (COMIBOL), for mineral exploration and new mining equipment to improve productivity. The state petroleum company, Yacimientos Petroliferos Fiscales Bolivianos (YPFB), would receive financing for exploration and oilfield development as well as for the proposed natural gas pipeline between Bolivia and Brazil, provided that studies confirm the existence of adequate gas reserves.

Productivity of Bolivia's mineral industries has been hampered by the lack of investment by COMIBOL and the private mining companies in exploration to provide against the declining grade in ore deposits. To help solve this problem, the International Development Association (IDA)—the World Bank's affiliate for concessionary lending—approved a $7.5 million credit to provide financial, management, and technical support to the Fondo Nacional de Exploracion Minera (FNEM) established in 1977. The credit will assist the operations program of the exploration fund for the period 1979-82, estimated to cost $17 million.

FNEM will initially concentrate on financing exploration projects of privately owned small and medium mining enterprises as well as COMIBOL. FNEM was expected to finance general survey works for about 40 mining projects, about 25 preliminary studies and sampling, about 8 detailed reserve evaluation works, and 5 feasibility studies. Additional financing for FNEM will be provided through bilateral grants from the Bureau de Recherches Géologiques et Minières of France ($0.5 million) and from the Gesellschaft fur Technische Zusammenarbeit of the Federal Republic of Germany ($3.8 million).

Cognizant of Bolivia's unexploited mineral potential and recognizing Bolivia's lack of financial resources and necessary technology, in April 1979 COMIBOL announced its interest in entering into joint ventures to explore and develop the country's mineral deposits. COMIBOL was in the process of elaborating the basic conditions for such joint ventures with foreign mining firms on a nondiscriminatory basis. In late 1979, the head of COMIBOL became the new Minister of Mining and Metallurgy.

It has been long considered that the major impediment to increasing investment in Bolivian mining is the tax system for the sector. The Government was considering revising the tax system applied to COMIBOL and the private mining enterprises, but not reforming it. The revision would remove the 7.5% special export levy and raise the income tax to 53%. However, the 53% tax would still be imposed on the selling price minus a Government-set presumptive cost. Thus, it would not be a true profits tax, nor would it encourage exploration and development expenditures since these are not considered tax deductible "business expenses."

In February 1979, the Minister for Overseas Development announced in Parliament that the United Kingdom would resume its aid program to the Bolivian mining industry that had been suspended in 1977 on human rights grounds. The United Kingdom loan, equivalent to $40 million, was granted to the Government but designed to assist COMIBOL in reequipping a number of its mines.

PRODUCTION

Bolivia's decline in mineral production in the last 2 years was caused by persistent long-term factors and the sharply lower mine and smelter output in November and December 1979. The November slump was a result of the Natusch coup. The long-term weakening in production derived from: exhaustion of reserves, increases in production costs, declining mill recovery, deteriorating capital stock, and the continuing lack of investment in plant and exploration by COMIBOL and the private mining companies.

Mineral production in 1978 was generally at a lower level than that of 1977 with the notable exception of gold and silver. The downtrend continued for most commodities in 1979 except again for gold, which responded to higher world prices. Bolivia's output of tin, lead, and zinc suffered decreases in both 1978 and 1979, and bismuth had a severe decline in 1979. The drop in lead in 1978 is attributed to COMIBOL's operations despite the very favorable results of the medium miners.

Production of tin by COMIBOL, the main producer, is shown below in tons of fine metal:

Year	Quantity
1976	20,540
1977	22,251
1978	21,471
1979	19,000

In 1979, COMIBOL's output of lead decreased 25% to 9,526 tons, and zinc in concentrate decreased 29% to 27,413 tons.

The National Association of Medium Miners, established in 1939 and comprised of 25 companies, reported a sharp increase in lead (51%) and a small gain in tungsten (5%). Output by the medium miners in 1978 decreased.

While production of natural gas continued to increase, 4% in 1978 and about 2% in 1979, output of crude petroleum remained in its serious downtrend since the peak year of 1973.

Table 1.—Bolivia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS[2]				
Antimony:				
Mine output, metal content	[r]17,015	12,392	12,672	[3]13,019
Metal	[4]1,744	3,450	2,196	2,500
Arsenic, mine output, white arsenic equivalent[e]	5	NA	--	NA
Beryllium: Beryl ore (10%-12% BeO)[4]	[e]30	--	--	--
Bismuth:				
Mine output, metal content	612	684	482	450
Metal	[4]263	483	167	200
Cadmium, mine output, metal content	[5]142	175	197	195
Copper, mine output, metal content	[r]5,100	3,738	3,266	1,797
Gold, mine output, mine content[6] troy ounces	[r]41,540	24,293	24,660	[3]30,319
Iron ore:[4]				
Gross weight	--	4,328	35,313	35,000
Metal content	--	2,705	22,071	22,000
Lead:				
Mine output, metal content	16,386	19,347	18,042	15,359
Metal including alloys	--	88	--	--
Manganese ore:				
Gross weight[e]	12,265	8,586	1,237	[3]371
Metal content	3,680	2,576	371	[3]270
Silver, mine output, metal content thousand troy ounces	5,091	6,254	6,439	[3]5,742
Tin:				
Mine output, metal content	[r]30,315	32,616	30,883	[3]27,648
Metal, smelter	10,100	12,285	16,184	18,000
Tungsten, mine output, metal content	[r]3,182	2,955	2,852	2,647
Zinc, mine output, metal content	48,546	61,406	53,923	[3]51,621
NONMETALS				
Barite[4]	917	2,163	2,889	2,500
Cement, hydraulic	220,293	266,876	254,254	270,000
Feldspar-related minerals: Sodalite	[4]2	6	NA	NA
Gypsum, crude	[e]1,000	--	--	--
Magnesite[4]	80	--	NA	NA
Sulfur	15,000	6,000	14,726	15,000
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural:				
Gross million cubic feet	153,968	149,075	154,769	[3]157,090
Marketable do.	71,442	70,536	61,297	[3]70,237
Natural gas liquids:				
Natural gasoline thousand 42-gallon barrels	43	43	40	--
Liquefied petroleum gas do.	462	643	815	820
Petroleum:				
Crude do.	14,856	12,676	11,844	[3]10,169
Refinery products:				
Gasoline do.	2,453	2,649	4,223	[3]4,496
Jet fuel do.	406	485	605	[3]541
Kerosine do.	1,078	1,050	1,169	[3]1,045
Distillate fuel oil do.	1,363	1,679	1,847	[3]1,855
Residual fuel oil do.	1,353	1,500	1,525	[3]747
Lubricants do.	76	88	100	NA
Other:				
Liquefied petroleum gas do.	1,046	1,729	247	[3]370
Unspecified do.	NA	NA	2	[3]903
Refinery fuel and losses do.	171	127	97	[4]990
Total do.	7,946	9,307	9,815	[3]10,947

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, salt and a variety of crude construction materials (clays, crushed, broken, and dimension stone, and sand and gravel) are produced, but available information is inadequate to make reliable estimates of output levels.

[2] Unless otherwise specified, data represent actual production by COMIBOL and small- and medium-scale mines.

[3] Reported figure.

[4] Data represent exports and are regarded as being virtually equal to production.

[5] Cadmium contained in zinc concentrates produced by COMIBOL. (Cadmium is not recovered in elemental form in Bolivia.)

[6] COMIBOL output plus sales by placer mines. (Small- and medium-scale mines cannot legally export gold).

TRADE

Bolivia's exports of mineral commodities in 1977 and 1978 are given in table 2. Official data on imports of minerals and mineral fuels have not been available from Government sources on a regular basis since 1969. The import data for that year may be found in the Bolivia Chapter of Volume III of the 1972 Minerals Yearbook. The import data shown in table 3 covering 1971, 1972, and 1975 are the most recent data available.

The volume of exports of most leading mineral commodities decreased in 1978 and 1979 with the notable exception of antimony concentrate, which increased sharply in 1979.

Preliminary data on Bolivia's most important mineral exports in 1979 are given below in tons of fine metal content except as indicated:

Commodity	Volume	Value (million U.S. dollars)
Tin (refined, concentrate)	26,484	396
Natural gas million cubic feet	60,961	105
Silver thousand troy ounces	5,832	58
Zinc	53,923	43
Petroleum products thousand barrels	1,245	37
Tungsten	2,647	35
Antimony	13,266	22
Lead	15,633	18

The contributors to Bolivia's foreign exchange earnings in the minerals sector are as follows:

Entity	Export value (million U.S. dollars)	
	1978	1979
COMIBOL	193.0	169.9
Smelters (ENAF)	209.7	244.0
Medium miners	68.0	81.2
Small miners	42.2	61.8
Other exporters	2.9	8.1
Subtotal	515.8	565.0
YPFB:		
Natural gas	78.5	104.9
Petroleum	42.3	36.7
Subtotal	120.8	141.6
Total	636.6	706.6

In late 1978, COMIBOL temporarily suspended shipments of concentrate of tin, lead, and tungsten through the rail line to Antofagasta, Chile, to protest the rise in rail freight rates. The Antofagasta and Bolivia Railway company is British owned.

For the first time in 1978, the value of natural gas exported exceeded the value of petroleum exports, making natural gas Bolivia's second most important mineral export commodity after tin.

Exports of natural gas, all to Argentina, decreased in 1978 and then rebounded to a historic high in 1979 of almost 61 billion cubic feet. The 34% increase in export value in 1979 also benefited from an increase in renegotiated gas prices. Exports of crude petroleum continued to decline since the peak year of 1973 when almost 12 million barrels were exported. In October 1978, exports of crude petroleum were cut off to meet domestic demand. Petroleum exports in 1979 were primarily gasoline.

Table 2.—Bolivia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS[1]			
Antimony:			
Ore and concentrate	12,391	8,330	Unites States 7,596.
Metal, alloyed	1,431	2,197	United States 1,224; Netherlands 685; Republic of Korea 94.
Bismuth:			
Ore and concentrate	52	14	NA.
Metal, alloyed	483	117	Belgium-Luxembourg 113; Argentina 2; Colombia 2.
Cadmium[2]	150	93	United States 58.
Copper ore and concentrate	3,174	2,990	NA.
Gold troy ounces	27	66	All to Chile.
Iron ore and concentrate	2,705	22,071	NA.
Lead:			
Ore and concentrate	19,878	16,482	United States 11,113.
Metal, alloyed	88	86	NA.

See footnotes at end of table.

Table 2.—Bolivia: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS[1] —Continued			
Manganese ore	2,576	371	NA.
Silver ore and concentrate thousand troy ounces	6,729	6,358	United States 4,173.
Tin:			
Ore and concentrate	18,413	13,818	NA.
Metal:			
Smelter products	12,047	14,198	United States 5,120; U.S.S.R. 4,373; Netherlands 1,887.
Anodic	298	1,263	All to United States.
Alloys:			
Crude	333	419	West Germany 378; United Kingdom 41.
Other	136	197	NA.
Tungsten ore and concentrate	2,820	2,852	United States 1,450.
Zinc ore and concentrate	61,356	51,621	United States 26,629.
NONMETALS			
Barite	2,163	2,889	NA.
Gypsum	--	1,000	NA.
Stone:			
Calcite	--	1,294	NA.
Sodalite	6	151	NA.
Sulfur, elemental	6,276	14,726	NA.
Other	--	26	All to Chile.
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural million cubic feet	57,887	55,847	All to Argentina.
Petroleum:			
Crude thousand 42-gallon barrels	4,489	2,863	Argentina 1,971; United States 892.
Refinery products:			
Gasoline, motor 42-gallon barrels	264	160	NA.
Kerosine do	594	--	
Diesel oil do	839	1,777	NA.
Liquefied petroleum gas do	43,501	99,883	NA.
Total do	45,198	101,820	

NA Not available.

[1] All data are in terms of metal content of the material shipped.

[2] Cadmium contained in zinc ore and concentrate.

Table 3.—Bolivia: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1971	1972	1975	Principal sources, 1972
METALS				
Aluminum:				
Oxide and hydroxide kilograms	NA	326	NA	Argentina 322; West Germany 3; East Germany 1.
Metal including alloys, all forms	403	436	850	France 97; Austria 84; Belgium-Luxembourg 43.
Antimony metal including alloys, all forms kilograms	234	160	1,980	Argentina 140; West Germany 20.
Arsenic:				
Oxide and acids do	NA	4,219	NA	Belgium-Luxembourg 4,210.
Metal do	4	4,312	NA	All from West Germany.
Bismuth metal including alloys, all forms do	18	16	15	West Germany 15; United States 1.
Chromium oxide and hydroxide do	NA	1,948	NA	West Germany 1,052; Argentina 532; Japan 360.
Cobalt oxides and hydroxides do	NA	25	NA	All from United States.
Copper:				
Concentrate do	--	2	--	All from Peru.
Metal including alloys, all forms	126	181	341	Chile 59; Argentina 29; United States 29; Peru 22.
Gold metal, partly worked value	--	$45	--	All from United States.
Iron and steel metal:				
Pig iron, sponge iron, granules, powder, scrap	203	2,048	(2)	Argentina 950; Chile 678; West Germany 420.
Ferroalloys	710	194	448	Netherlands 80; United States 67; Italy 31.
Steel, primary forms	10	12	38	Mainly from Argentina.

See footnotes at end of table.

Table 3.—Bolivia: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1971	1972	1975	Principal sources, 1972
METALS —Continued				
Iron and steel metal —Continued				
Semimanufactures:				
Common steel:				
Bars, rods, angles, shapes, sections	NA	15,189	16,662	Argentina 10,529; Belgium-Luxembourg 1,557; Japan 1,002.
Plates and sheets	NA	9,954	NA	Japan 6,524; West Germany 1,488; Austria 487.
Hoop and strip	NA	354	NA	West Germany 244; Brazil 43; Japan 25.
Rails and accessories	NA	3,286	NA	United Kingdom 3,103; United States 76.
Wire	NA	4,933	NA	NA.
Pipes, tubes, fittings	NA	13,624	NA	Argentina 7,133; Japan 2,887; Brazil 1,404.
Castings and forgings	45	42	NA	West Germany 19; United States 12; Brazil 5.
High-carbon and alloy steel	NA	1,453	NA	Argentina 792; United States 333; West Germany 162.
Lead:				
Oxides	NA	4	NA	United States 2; West Germany 1.
Metal including alloys, all forms	7	4	34	Mainly from United States.
Magnesium metal including alloys, all forms kilograms	34	25	--	All from West Germany.
Manganese oxide do	NA	66,315	NA	West Germany 35,589; Japan 30,572.
Mercury 76-pound flasks	NA	16	NA	United States 12; West Germany 3.
Molybdenum metal including alloys, all forms kilograms	168	413	3,260	Netherlands 292; Argentina 121.
Nickel metal including alloys, all forms	7	36	5	Argentina 33; Japan 2.
Platinum-group metals including alloys, all forms troy ounces	5,015	21,541	1,640	All from Argentina.
Tin metal including alloys, all forms	1	3	8	Japan 1; Netherlands 1.
Titanium oxide	NA	140	NA	United Kingdom 116; West Germany 24.
Tungsten metal including alloys, all forms kilograms	356	644	134	Netherlands 480; West Germany 164.
Zinc metal including alloys, all forms	159	102	707	Mainly from Peru.
NONMETALS				
Abrasives, natural, except diamond	10	54	13	Austria 30; Argentina 18; Brazil 2; United States 2.
Asbestos kilograms	1,172	52	73	Mainly from Brazil.
Boron materials:				
Crude natural borates do	22	170	58	West Germany 104; Argentina 51; United States 15.
Oxide, acid, and borates, n.e.s do	NA	4,677	NA	United States 2,010; West Germany 867; Argentina 787.
Cement, hydraulic, including clinker	2,860	1,875	6,121	Argentina 745; Japan 659; Denmark 233.
Chalk	5	5	18	All from Belgium-Luxembourg.
Clays, crude:				
Bentonite	147	321	NA	Argentina 196; United States 125.
Decolorizing earth	19	11	NA	West Germany 10; Argentina 1.
Fire clay	104	12	NA	Mainly from United States.
Kaolin	38	39	NA	United States 28; Argentina 10.
Other	(2)	14	NA	All from United States.
Diamond, gem carats	--	45,000	--	All from Switzerland.
Diatomite and other infusorial earth	59	119	301	Mainly from United States.
Fertilizer materials:				
Crude and manufactured:				
Nitrogenous	NA	2,356	NA	West Germany 1,600; France 501.
Phosphatic	NA	465	NA	Netherlands 430; Italy 20.
Potassic	NA	--	NA	
Mixed	NA	4,003	NA	United States 3,040; Argentina 396.
Ammonia, anhydrous	NA	37	NA	West Germany 17; Argentina 6; Brazil 4; United States 4.
Gypsum and plasters kilograms	51	476	--	All from United States.
Lime do	--	35	--	All from Argentina.
Mica:				
Crude, including splittings and waste	--	14	16	All from United States.
Worked, including agglomerated splittings kilograms	NA	108	NA	Mainly from West Germany.
Pigments, mineral:				
Natural, crude	12	8	17	Mainly from Netherlands.
Iron oxides, processed	NA	82	NA	West Germany 73; Spain 5; United Kingdom 4.
Precious and semiprecious stones, except diamond, natural and manufactured[3] kilograms	92	54	75	Switzerland 46; France 5; West Germany 3.
Sodium and potassium compounds, n.e.s	NA	534	NA	United States 169; West Germany 145; Belgium-Luxembourg 123.

See footnotes at end of table.

Table 3.—Bolivia: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1971	1972	1975	Principal sources, 1972
NONMETALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked kilograms	--	8,150	--	all from Argentina.
Worked do	NA	36	NA	All from Japan.
Quartz and quartzite	--	5	(3)	Mainly from Argentina.
Sand, excluding metal bearing	33	11	59	United States 9; Netherlands 2.
Sulfur:				
Elemental:				
Other than colloidal kilograms	3,000	200	612	All from Belgium-Luxembourg.
Colloidal	47	267	NA	United States 145; Peru 87; Argentina 10; Belgium-Luxembourg 8.
Sulfur dioxide kilograms	NA	71	NA	Mainly from Argentina.
Sulfuric acid	NA	60	NA	Argentina 24; Brazil 11; West Germany 9; Chile 8.
Talc, steatite, soapstone, pyrophyllite	50	64	20	United States 18; West Germany 16; United Kingdom 11; Italy 10; Netherlands 4.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	5,844	3,142	5,852	Argentina 3,101; United States 29; Belgium-Luxembourg 11.
Carbon black	68	98	NA	Argentina 67; Brazil 14; United States 11; West Germany 6.
Coal, all grades	750	13	756	Mainly from West Germany.
Coke and semicoke	592	70	547	West Germany 36; Belgium-Luxembourg 31; Brazil 3.
Hydrogen and other rare gases	3	3	NA	All from Netherlands.
Petroleum refinery products:				
Gasoline 42-gallon barrels	103,930	101,967	94,000	Chile 92,809; Netherlands Antilles 4,610; United States 3,364.
Kerosine and jet fuel do	1,406	(2)	--	All from United States.
Distillate fuel oil do	48	(2)	--	Do.
Residual fuel oil do	--	20	--	Do.
Lubricants do	4,401	3,038	51,000	United States 2,723; Netherlands 91.
Paraffin wax do	17,284	14,961	NA	Argentina 5,690; Taiwan 3,762; United States 2,377; Japan 1,779.
Bituminous mixtures do	77,314	20,846	NA	Argentina 20,568; United States 200.
Other do	113	9	8,000	Mainly from United States.
Total do	204,496	140,841	153,000	

NA Not available.

[1] Data should not be taken as a complete presentation of the mineral imports of Bolivia for the years shown but are the latest available data.

[2] Less than 1/2 unit.

[3] Includes onyx.

COMMODITY REVIEW

METALS

Antimony.—In 1978 and 1979, Bolivia ranked in second place after China as a world producer of antimony. Production of antimony metal remained below the full capacity of ENAF's antimony smelter rated at 4,270 tons per year.

In 1978, a National Committee of Antimony Producers was formed to promote the interests of the private miners (the major producers) and to work towards establishing an international antimony council.

Gold.—In response to high world prices, the gold-producing cooperatives and small miners produced 21,604 troy ounces in 1979 and accounted for 71% of Bolivia's output compared with the 55% share in 1977.

Iron Ore.—There were no new developments in Bolivia's plans to exploit the Mutún iron ore deposits near Santa Cruz. Project costs and lack of available financing as well as logistical problems obviated moving ahead at this time.

Iron and Steel.—The national steel plan submitted by the Empresa Siderúrgica Boliviana S/A (SIDERSA) was under review by the Ministerio de Coordinación y Planeamiento (CONEPLAN). SIDERSA's plan, centered on the Mutún iron ore deposit, was based on a feasibility study by Arthur McKee completed in September 1977. During the meeting of the World Bank consultative group in Paris, the Bolivian delegates were seeking foreign financing for the first phase of the plan involving 450,000 tons of steel per year.

Lead.—The mine operated by Quioma S.A., incorporated into the Medium Miners Association in 1977, was chiefly responsible for the sharp increase in lead output by this group in 1978. Quioma increased its output by more than 1,000 tons from 1977.

After delays caused by the austerity policies of the Government, construction of the lead-silver smelter at Karachi Pampa near Potosí, a joint venture of COMIBOL and ENAF, was expected to begin in early 1980 instead of March 1979 as originally scheduled. There was concern that Bolivia would not have sufficient lead reserves to feed the smelter designed to produce 24,000 tons of lead per year.

Tin.—In 1978, Bolivia for the first time succeeded in refining more than 50% of the tin concentrate produced. ENAF's smelter output at Vinto, however, was below its rated capacity of 20,000 tons per year and did not reach the output target for 1979. The 10,000-ton-per-year low-grade smelter that was originally scheduled for completion at Vinto in early 1979 was expected to be completed and tested in early 1980. Since this smelter was designed during a period of lower silver prices, it will not have the capacity to separate the silver contained in the feed, a potential financial loss to ENAF.

Construction of COMIBOL's tin volatilization plant at La Palca, near Potosí, by Soviet Machinoexport, was hampered by landslides that destroyed a considerable part of the plant. It was feared from the damage that the revised startup date of September 1979 would be moved to early 1981. There were no plans to convert the La Palca plant from fuel oil (in short supply in Bolivia) to use the country's abundant natural gas reserves until the plant is in operation.

Production and export of tin by COMIBOL and the medium miners were in a downtrend during 1978 and 1979. As a consequence, Bolivia lost to Thailand her long-held second place as a free world producer of tin. Loss of production in 1979 resulted from widespread strike action by the country's miners in the aftermath of the November political coup. Of the 25 private companies in the National Association of Medium Miners, 17 were involved in tin mining, producing 6,626 tons in 1978 and 5,937 tons in 1979 in terms of metal.

COMIBOL's tin reserve situation was expected to change if results of a prefeasibility study at its Catavi mine were substantiated by drilling. It is proposed to convert Catavi to mining by open pit, which could possibly begin in 1983 if justified economically. The drilling program was expected to be completed in mid-1979 on the deposit, estimated to contain 80 million tons of ore grading 0.3% tin.

Another step away from underground tin mining is the proposal to dredge the Playa Verde alluvial deposits at the Huanuni mine site downstream from Catavi. COMIBOL was being assisted by the Malaysian Mining Corp (another state entity) in assessing the viability of a project to produce 2,000 tons per year of tin.

The British Institute of Geological Sciences was cooperating with the Servicio Geológico de Bolivia (GEOBOL) in exploring tin deposits in the Departments of Beni and Santa Cruz. The first phase of the study initiated in early 1976 established the presence of alluvial deposits of tin, cobalt, and nickel. The second phase of the study is scheduled to end in 1981.

World tin prices continued in an upward trend, averaging $5.87 per pound in 1978 and $7.05 per pound in 1979 compared with $4.99 per pound in 1977. At the meeting of the International Tin Council in January 1979, Bolivia requested an upward revision of the buffer stock price levels. The fifth International Tin Agreement will expire in June 1981.

Tin sales from the strategic stockpile managed by the General Services Administration (GSA) of the U.S. Government were authorized by legislation signed by the President on December 29, 1979. The proposed sales had been strongly and persistently opposed by Boliva. The 35,000 tons authorized to be sold represents 17% of the 203,698 tons in the U.S. stockpile and were to be sold at biweekly auctions at the rate of 10,000 tons per year beginning in July 1980. Yearly sales by GSA would equal about 20% of 1978 U.S. tin imports, which were mostly from Malaysia and Thailand. In the period 1975-78, only 6% of U.S. tin imports were from Bolivia.

The GSA stated that it consulted with the International Tin Council before announcing the terms of the excess tin sales. The legislation signed also provided for a donation of 5,000 tons from the U.S. stockpile to the buffer stock of the ITC. GSA tin sales totaled 148,214 tons between 1962 and mid-1978 when GSA suspended commercial offerings. The peak year was 1964 when 31,147 tons were sold.

Tungsten.—Production of tungsten concentrate by COMIBOL, chiefly by its cooperatives of Kami and Bolsa Negra, increased 28% to 1,340 tons in 1979, while output by the medium miners (the most important producers) and the small miners decreased. Although the volume of exports decreased in 1979 to 2,647 tons, tungsten concentrate continued as Bolivia's fourth most valuable export commodity.

In March 1979, Bolivia hosted a gathering of tungsten producers in Santa Cruz, similar to the one held in La Paz in 1975, to consider the creation of a producer's organization with possibly some participation by interested consumer nations. At the meeting, attended by Australia, Bolivia, Brazil, Mainland China, Mexico, Peru, Portugal, and Thailand, it was agreed by Bolivia to delay plans for a possible producers' agreement until after the next two United Nations meetings on tungsten under UNCTAD.

Zinc.—Production of zinc concentrate was in a downward trend such that by the end of 1979 it was 28% below the peak level of 1977. COMIBOL's output increased in 1978, then dropped in 1979 to 27,413 tons. The subsidiary mining companies of Matilde, Quechisla, and Colquiri accounted for the bulk of COMIBOL's zinc production.

The significant decrease in zinc production by the medium miners was attributed to the closing down of Caballo Blanco S.A. of Potosí in September 1978 because of Government intervention. Output by this group of 20,975 tons in 1978 declined further to 16,728 tons in 1979.

NONMETALS

Boron.—Although production of boron minerals has been limited, apparently large resources of mostly ulexite (sodium-calium borate) provide potential for future exploitation. Production and export data have not been available since departure of an English mining company in 1952, when recovery of borates in southwest Bolivia was discontinued. Upon specific requests from COMIBOL and ENAF, small mining cooperatives have produced limited amounts of borates to meet the needs of the Telamayu bismuth smelter and refinery and the Vinto tin smelter. Currently the only state entity interested in borates is Cossmil (the Armed Forces Social Security Agency) with several borate concessions, including the large Salar de Challviri deposit.

Bolivia has a number of known deposits of borates in the southwest near Chile, and several have been evaluated in detail. Cossmil has evaluated the Rio Grande, Challviri, and Laguani borate deposits, while the deposits located in the salars of Capina, Pastos Grandes, and Laguna Colorado remain to be evaluated. Borate reserves are estimated at 65 million tons, of which 7 million tons are measured reserves.

MINERAL FUELS

Natural Gas.—For the first time in Bolivia's fuels history, the value of exports of natural gas exceeded the value of petroleum exports, as indicated below in million U.S. dollars:

	1976	1977	1978	1979
Natural gas	54.6	66.8	78.5	104.9
Petroleum	112.6	67.4	42.3	36.7
Total	167.2	134.2	120.8	141.6

After declining in 1978, exports increased to a new high in 1979 of 60,961 million cubic feet, an increase of 9.2%, valued at almost $105 million. All exports continued to go to Argentina. In 1979, gas exports represented 12% of Bolivia's total exports, compared with 8% in 1975.

The price of natural gas was renegotiated to $1.10 per 1,000 cubic feet effective January 1, 1978, increasing to $1.20 per 1,000 cubic feet for the period April-June 1978. During the second half of 1978 the price of $1.20 per 1,000 cubic feet was maintained. The rates agreed upon by Bolivia and Argentina for 1979 were $1.43 per 1,000 cubic feet effective January 1, 1979, and $1.54 per 1,000 cubic feet effective July 1, 1979. Another price revision took place in December 1979, effective as follows: $2.15 per 1,000 cubic feet on January 1, 1980, $2.42 per 1,000 cubic feet on May 1, 1980, and $2.51 per 1,000 cubic feet on June 1, 1980.

Bolivia and Argentina signed a second contract to increase the current volume of natural gas sold to Argentina to 220 million cubic feet per day.

Another notable event in 1978 was the startup of production at the Tita and La Vertiente Gasfields by the operations contractors, Occidental Boliviana Inc. and Tesoro Bolivia Petroleum Co., respectively. Also in 1978, Occidental discovered a new gas-condensate field, Porvenir No. 1, on the Chaco block northeast of Tarija in southern Bolivia. Occidental said its Porvenir Well has a potential of 17.6 million cubic feet per day of natural gas and 1,500 barrels per day of crude oil. By the end of 1978, the Tita

Field, discovered in 1976, was producing 50 million cubic feet per day of natural gas and 3,200 barrels per day of oil. The new Tita Field in 1978 became Bolivia's third most important gas producer, after the Rio Grande and Colpa Fields. Occidental's net share of production is 50% after payment of Bolivian taxes and royalties and is sold to YPFB in the field at the connections to YPFB's export pipeline system. During 1979, Occidental drilled a second gas-condensate well in the Porvenir Field, confirming significant reserves of gas and condensate.

In 1978 YPFB confirmed the discovery of a small gasfield, Rio Seco in the Department of Santa Cruz, and the discovery of Vuelta Grande in the Department of Chuquisaca, with promising reserves of natural gas and condensate.

In October 1978, Bolivia and Brazil signed a letter of intent covering future gas sales to São Paulo, Brazil, via a planned gas pipeline from Santa Cruz to supply 400 million cubic feet per day. The amount of gas reserves needed to implement the final contract will be determined with loans from the World Bank and the Inter-American Development Bank. Bolivia's largest gas reserves are located north and northwest of Santa Cruz, an area being held in reserve to supply the planned gasline to Brazil. At the end of 1978, Bolivia's proved reserves of natural gas were estimated at 5.99 trillion cubic feet. At current rates of consumption, proved gas reserves would last 60 years.

Petroleum.—During 1978 and 1979, the downward trend in the production of crude petroleum continued since the peak year of 1973 when 17.3 million barrels were produced. In October 1978, for the first time in 25 years, Bolivia discontinued exports of crude petroleum destined primarily for Argentina. This resulted from the decrease in oil production coupled with increases in domestic consumption of 5.4% in 1978 and 11.5% in 1979. Bolivia's crude oil output by field is given in table 4 and includes output from the new oilfields of Vuelta Grande, Tita, Porvenir, and La Vertiente.

Table 4.—Bolivia: Production of crude oil and condensate by YPFB and contractors,[1] by field

(Thousand 42-gallon barrels)

Field	1975	1976	1977	1978	1979	Percent change 1978-79
Rio Grande	4,578	5,412	5,080	4,660	4,233	-9
Monteagudo	2,471	1,867	1,486	1,267	1,290	+2
La Peña	2,069	2,824	2,208	1,829	1,060	-42
Tita	--	--	--	919	1,042	+13
Caranda	1,527	1,345	1,165	853	641	-25
Colpa	1,363	1,029	841	630	553	-12
Camiri	566	559	512	465	441	-5
Caigua	1,568	1,319	641	355	176	-51
Cambeiti	--	16	178	202	154	-24
Palmar	--	--	--	261	145	-45
Tatarenda	235	241	207	143	137	-4
Bermejo - Toro	83	58	88	82	105	+28
La Vertiente	--	--	--	17	80	+364
Guairuy	78	53	35	32	30	-6
San Alberto	58	52	44	35	29	-16
Camatindi	28	31	36	33	26	-21
Other fields	[2]108	[3]50	[4]155	[5]61	[6]27	-56
Total	14,732	14,856	12,676	11,844	10,169	-14

[1] In 1978, Occidental produced from the Tita Field and Tesoro from the new La Vertiente; in 1979 Occidental's Porvenir Field entered production.

[2] Includes output from Los Monos, Buena Vista, and Tigre.

[3] Includes output from Los Monos, Buena Vista, Tigre, and Montecristo.

[4] Includes output from Los Monos, Buena Vista, Montecristo, and Espejos.

[5] Includes output from Buena Vista and Espejos and a small amount from Tigre. Los Monos was shut down.

[6] Includes output from Vuelta Grande, Buena Vista, Espino, and Porvenir.

The prospect that Bolivia would soon become a net importer of crude oil to meet domestic needs, especially for diesel oil, fuel oil, and kerosine, has been avoided by the possibility of increasing production from the new La Vertiente Field. Output from La Vertiente, under operations contract with Tesoro, can possibly be increased to 10,000 to 12,000 barrels per day, or one-half of domestic consumption.

The prices for most refined petroleum products were among the lowest in South America. Prices for refined products were raised in November 1979, but to a level well below that indicated by world oil prices. The low prices have encouraged a high level of petroleum product contraband to Paraguay and Brazil. The refining and sale of hydrocarbon products in Bolivia was performed exclusively by YPFB, the state oil company. YPFB operated six refineries with a total capacity of 84,600 barrels per day, compared with current refinery production of 26,000 barrels per day. This capacity includes the expansion of the Valle Hermoso (Cochabamba) refinery completed by A.G. McKee in November 1978 and the Palmasola (Santa Cruz) refinery. The new refinery capacity places Bolivia in a position to be able to increase exports of petroleum products.

In 1978 YPFB signed only one operations contract with Tesoro Bolivia Petroleum Co. covering an area in the Department of Tarija. This brought to 20 the total of contracts signed by YPFB with foreign oil companies since 1973, of which only 6 were active as of the end of 1978. By yearend 1978, the contractors had invested $199 million in the same period. YPFB invested $110 million in exploration and development. During 1978 and 1979, the total of 11,240 meters drilled in exploratory wells was the highest ever.

As of December 1979, estimated reserves of crude oil were 170 million barrels, including new discoveries. At 1979 rates of production, the country's proved reserves would last about 16 years.

Uranium (Nuclear Fuels).—In February 1979, the Government and the Compagnie Générale des Matières Nucleaires (COGEMA) of France executed a letter of intent covering a $10 million exploration program in eastern Bolivia for commercially exploitable uranium. The Bolivian Nuclear Commission (COBOEM) will act for the Government in contracting with COGEMA.

The COGEMA venture represents the second major attempt to find uranium in Bolivia. During 1974-78 AGIP, a subsidiary of the Italian Government, spent about $7 million prospecting in the Bolivian altiplano and in the South. Although radiometric sensing of the exploration area showed encouraging anomalies, the deposits proved too shallow to exploit commercially.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Bolivian pesos ($b) to U.S. dollars at the rate of $b20 = US$1.00 in 1978 and $b20.75 = US$1.00 in 1979.

[3] National Association of Medium Miners. Annual Report 1978. La Paz, p. 11.

The Mineral Industry of Botswana

By Janice L. W. Jolly[1]

Botswana's mineral industry was the fastest growing sector of the economy in 1978 and 1979, providing a major portion of foreign exchange earnings and a substantial share of Government revenue. Diamond earnings nearly doubled during 1978, accounting for 58% of the total 1978 mineral production value of approximately $160 million[2] and 68% of the total 1979 mineral production value of $296 million. Although nickel-copper matte production increased by 28%, lower prices for the contained metals resulted in receipts that were similar to those of 1976 and 1977. Expansion at the Orapa and Letlhakane diamond mines continued, and a final agreement for development of the new Jwaneng mine was signed. Despite major financial restructuring and other cost-containment exercises, the debt of BCL Ltd. (formerly Bamangwato Concessions Ltd.) increased again. Planned expansions at Pikwe and Selibe continued, funded by the principal shareholders.

Mineral exploration for coal, uranium, asbestos, and base metals was underway in various parts of the country. The final report of the airborne magnetic survey conducted by the Canadian International Development Agency (CIDA) and the Botswana Geological Survey Department was released. The report indicated a positive potential for many minerals under the Kalahari sands, which cover nearly 80% of the country. The magnetic data outlined the most favorable areas for mineral occurrences and also showed the thickness of Kalahari sediment cover. A thick sedimentary basin was outlined in southwestern Botswana, holding a potential for petroleum exploration. An extensive follow-up program that was expected to include drilling was being planned by the Geological Survey. Also, a record number of 69 maps was completed for the Botswana Government for the year ending March 31, 1978, according to the British Directorate of Overseas Survey (DOS), which was doing the surveys. Covering the Okavango and Boteli Rivers and much of the country's northeastern area along the Botswana-Zambia Highway, the maps were made on a scale of 1:50,000, and these maps were expected to assist in mineral exploration. The Botswana Government was negotiating with Japanese, West German, and Canadian delegations for technical and financial assistance in mineral exploration. Falconbridge Mines of Canada held several prospecting licenses and was actively exploring for precious stones, copper, nickel, gold, silver and radioactive minerals.

A new mining policy (Act 30, 1976, S.I. 175, 1976) was announced that was designed to promote foreign investments and bring the law into line with requirements of an expanding mineral industry. Under the policy, the award of a mining lease to the holder of a prospecting license was to be fully guaranteed, providing the economic potential of the mineral discovery was demonstrated.[3]

At the Southern African Development Coordination Conference held at Arusha, Tanzania, in July, 1979, Botswana urged an economic integration of the 10 states in southern Africa outside of the Republic of South Africa. Specifically, a trans-Kagalagadi railway line and a road from Francistown to Namibia and Angola were recommended to encourage trade and communications between the three countries. This would frustrate current recommendations by the Republic of South Africa for a "Constellation of Southern African States" and lessen dependence on southern transport routes.[4]

PRODUCTION AND TRADE

In 1978, the mineral production of Botswana consisted of coal, valued at $2.8 million; nickel-copper matte, valued at $62 million; diamond, valued at $92 million; semiprecious stones, valued at $3,600; and talc, crushed stone, sand and gravel, valued at $1.3 million. By 1979, Botswana had become the world's fourth largest producer of diamond, with revenues from diamond estimated at over $200 million and its share of world output was expected to increase as a result of anticipated new production. World demand for diamonds remained buoyant in 1979, and the high prices realized in 1978 were maintained. Although operating costs for BCL Ltd. were contained during 1978, the benefits of increased production were offset by lower nickel prices (which averaged $1.97 per pound in 1978, compared with $2.19 per pound in 1977).

Total exports, valued at $221 million in 1978 and $325.7 million for the first three quarters of 1979, reflected increased earnings from diamond, following substantial price increases for the three consecutive years. Diamond exports accounted for 41% of Botswana's total exports in 1978 and for 46% in 1979.[5] Prices for cobalt more than doubled, following a period of unrest in Zaire. Total imports rose sharply to $353 million, partly due to the influx of capital equipment and other materials for the new Jwaneng diamond mine. Copper-nickel matte exports were valued at $61 million in 1978 and $56 million for the first three quarters of 1979. The demand for nickel did not improve in 1979, but prices for copper continued to rise.

In 1976, Botswana became eligible for the United States General Selected Preferences (GSP) Trade Act benefits. However, the country's copper-nickel matte was imported into the United States under the import classification for copper matte. Because BCL's copper matte imports into the United States accounted for 89% of total U.S. copper matte imports for 1976, Botswana lost GSP eligibility. The GSP Act stipulates that a material imported for consumption must not exceed the competitive need limit for an import category. In 1978, AMAX Refining requested that the material be reclassified under a more appropriate category, such as nickel-copper matte, since the matte contained more nickel than copper, as well as the strategic material cobalt. Nickel, copper, and some cobalt were being sold to the Federal Republic of Germany, after processing at the AMAX Port Nickel refinery in Louisiana. During 1979, BCL was temporarily forced to cease exports to the United States because of a strike that led to a temporary closure of the Port Nickel plant.

The Botswana pula was revalued by 5% against the U.S. dollar on September 16, 1979, so that one pula was equal to 1.2679 U.S. dollars. The revaluation was aimed at reducing the cost of imported goods.

Botswana was seeking a maritime entry on the southwest African Coast. A proposal for building a railroad between Botswana and the Atlantic Ocean, across the Kalahari Desert, was being studied. The Commonwealth Technical Cooperation Fund was expected to participate in the study. The Government was also taking steps toward taking over that part of the Rhodesian-owned railroad which runs through Botswana to South African ports, with a view towards a complete takeover. The railroad, still operated by Rhodesia Railways, has been termed the economic lifeline of Botswana, since it carries most of the territory's mineral exports and imports. Botswana took delivery of its first South African-built railroad cars in May 1978.

Table 1.—Botswana: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978^{p}	1979^{e}
Coal, not further described	224,175	294,039	314,486	300,000
Cobalt, Co content of nickel-copper matte[2]	132	165	261	270
Copper:				
Mine output, metal content[3]	17,887	16,160	17,235	17,000

See footnotes at end of table.

Table 1.—Botswana: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
Copper —Continued				
Cu content of nickel-copper matte	11,927	11,788	14,615	15,000
Diamond:				
Gem[e] thousand carats	358	404	418	500
Industrial[e] do	2,026	2,287	2,367	2,840
Total do	2,384	2,691	2,785	3,340
Gem stones, semiprecious, rough, not further described kilograms	41,000	50,000	10,000	10,000
Nickel:				
Mine output, metal content[3]	22,254	19,859	21,859	21,800
Ni content of nickel-copper matte	12,579	12,094	16,049	16,050
Nickel-copper matte, gross weight	32,506	30,772	39,517	NA
Talc	[4]2,144	288	313	300

[e] Estimate. [p] Preliminary. NA Not available.

[1] In addition to the commodities listed, modest quantities of crude construction materials (clays, stone, and sand and gravel) presumably are produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[2] Figures approximate recoverable mine output.

[3] Analytic content of ore milled.

[4] Exports.

COMMODITY REVIEW

METALS

Copper-Nickel-Cobalt.— Selebi-Pikwe started production in February, 1974, 33 months after initial construction started. BCL Ltd. operated the concession and was owned 15% by the Government and 85% by the Botswana RST (BRST). The name of BRST's subsidiary, Bamangwato Concessions Ltd., was changed officially in 1977 to BCL LTD. BRST was owned 11.75% by Zambia Consolidated Investments (ZCI), 29.8% by AMAX, 30% by Anglo American/Charter Consolidated, and the remainder by the public. German involvement, including the West German Bank Kreditanstal fur Wiederauf (KfW), was about one-third of the total initial capital involved in mine development. Production and management problems and a soft metal market combined to make the first two years a financial loss. New management and technical expertise were brought in and many of the initial problems were solved by late 1976. Still, there remained huge debt servicing problems. A complex restructuring move on July 1, 1979, involved Charter Consolidated Ltd. Group, Minerals and Resources Corp. Ltd. (MINORCO), Anglo American Corp. of South Africa Ltd., De Beers Consolidated Mines Ltd., and Zambia Consolidated Investments (ZCI). ZCI transferred 19.7% of its preference share capital in BCL to De Beers, while retaining its 11.75% interest in BRST. In return, De Beers agreed to relieve ZCI and MINORCO of debt obligations to BRST and BCL, that amounted to $18.4 million, which had been borrowed to finance the mine.

AMAX, however, wrote off its entire carrying value ($91.7 million) in BRST, and the debt and marketing arrangements between the other investment partners were renegotiated and concluded on March 16, 1978. Under the new agreement, all of BCL's production was sold as matte to AMAX Nickel. High sales commissions paid previously to Metallgesellschaft AG of the Federal Republic of Germany were no longer payable, and a claim by AMAX for $8.7 million for a shortfall in matte delivery was settled for $1.5 million. Various claims made by Metallgesellschaft were also settled by a payment of $450,000, of which AMAX paid $180,000. The outstanding balances of loans from KfW and the Industrial Development Corp. of South Africa were reduced by prepayments without premium. BCL's principal shareholders agreed to provide two additional guaranteed loans, or other financial support, for pollution control and the second phase of BCL's mining project at Selebi.

An Outokumpu flash smelter and a sulfur-reduction plant had been originally teamed to recover sulfur at Selebi-Pikwe. The sulfur was to be sold to Triomf Fertilizers, but when the sulfur was not delivered, Triomf initiated a suit for alleged damages.

The suit was settled in 1978 for $3.9 million, but BCL remained liable for sulfur-pollution problems. BCL was relieved, however, of the obligation to produce sulfur for delivery to Triomf in the future under a process that had been shown not to be commercially viable. The royalty paid to Botswana was also renegotiated at 3% of the gross production value, compared with the 7 1/2% royalty on profits that was originally paid.

Despite the major financial restructuring and an improving metals market, BCL's debt increased again in 1978. By June 30, 1978, accumulated indebtedness amounted to $266 million. Capital expenditure for the year was put at $34 million, and further substantial amounts were needed. During the first 6 months of 1979, BCL Ltd. reported an operating profit of $8 million, compared with a loss of $240,000 for the corresponding 1978 period. Higher cobalt and copper prices coupled with increased production were responsible for the recovery. Production costs were contained, despite an overall inflation rate of 8.7% for the 12-month period ending with March 1979. Even though a profit was not made in 1978, a 28% increase in nickel-copper matte production was achieved in that year. The reasons for this increase included better underground mining rates and concentrator recoveries, operation of a new system for reclaiming stockpiled residues accumulated from previous years, and improved smelter furnace availability and smelting rates. Matte production and its estimated average metal content are shown below for 1975-78.

	1975	1976	1977	1978
Matte production metric tons	16,513	32,506	30,772	39,517
Matte content:[1]				
Nickel percent, average	37.9	36.5	39.3	40.6
Copper do	39.8	36.7	38.3	36.9
Cobalt do	.34	.41	.54	.66

[1] Average content for sulfur and impurities was 22% for each of the years shown.

As part of a planned expansion project, the No. 3 shaft at Pikwe was to be sunk to about 900 meters for deep-level mining, and surface facilities extended; the total cost was estimated at about $94 million. This would allow access to an additional 15 million tons of ore reserves. Existing underground operations were at a depth of about 350 meters. Funding for the expansion project was expected to be supplied by the principal shareholders. The smelter shutdown originally scheduled for July-August 1979 was rescheduled for 1980, when final commissioning of remaining plant projects was scheduled to take place.

NONMETALS

Clays.—Various types of clay materials were exploited for local use. Local brickmakers use the clays of flood plain and terrace deposits of the Peleng River, in the Lobatse area, and of the Notwani River, near Gaborone. Potential fireclays such as the Mmamabula fireclay occur in the Ecca Series of Karoo Age, but none was being exploited. Traditionally sought for making pottery are the clays from river banks and termite mounds, which have a high degree of plasticity. For instance, clay from Phaphane Hill, Mochudi, which resulted from weathered granite, was used by villagers at Morwa.[6]

Diamond.—De Beers Botswana Mining Co. (Proprietary) Ltd. reported production at the Orapa mine as 3,585,400 tons with a recovery grade of 68.5 carats per 100 tons, yielding 2,454,405 carats for 1978. This compared with a recovery grade of 67.98 carats per 100 tons and a yield of 2,345,010 carats in 1977. As a result of a 2-month delay in construction of the Orapa expansion project and other commissioning problems at the treatment plant, total tonnage treated in 1978 was 18% less than the target of 4.4 million tons. Major construction work on the Orapa plant expansion was completed, and the new facilities were commissioned in October 1978.

Mining of the ferruginous gravels surrounding the D/K1 and D/K2 diamond pipes continued at the Letlhakane mine. Mining of the D/K1 pipe itself started during the latter part of 1979. Heavy rains in early 1978 interrupted operations, but the 1.1 million tons treated during the year compared favorably with the amount treated in 1977. The recovery grade was 29.74 carats per 100 tons. Construction of the second stage of the Letlhakane plant was completed on schedule during the first half of 1979.

An agreement was signed between the Government and De Beers on April 11, 1978, for development of the new Jwaneng mine. Under the agreement, the mine will be developed as a joint venture by De Beers (50%) and the Government (50%). The Botswana Government exercised its option to subscribe up to 20% of the paid equity required for the project. A feasibility study on the new mine, prepared by Anglo American, based the projected treatment rate on a mine output of 400,000 tons per month. The mine was expected to start commercial production in mid-1982. A bulk sampling plant was erected in 1979 to assist in more detailed evaluation of ore reserves. It was estimated that the ore grade from Jwaneng would be higher than that of the Orapa mine, and that the Jwaneng mine would produce about 20% gem stones. A major groundwater resource was confirmed during 1978 that was expected to be sufficient for the mine's needs. At yearend 1978, work was in progress on the Kanye-Jwaneng main access road, the airfield, and the telecommunications facilities.[7] Construction of a new township was started in 1979.

Botswana signed an agreement in 1979 with Mabrodiam of Antwerp, Belgium-Luxembourg, to set up a diamond-cutting plant in Gaborone. Initially, a pilot plant employing 50 people was planned, eventually building up to 500 employees. The company is expected to start operations in 1980.

Botswana's diamond resources were estimated as follows: 60 million carats proven; 25 million carats identified; and 25 million carats undiscovered[8]. As part of a continuing prospecting program, De Beers was testing three small kimberlite pipes about 370 kilometers north of Orapa.

Soda Ash.—Toward the end of 1978, a Japanese consortium was given permission to evaluate the Sua Pan salt and soda ash deposit for eventual exploitation. Only part of one of the two great pans (the Sua Pan) of the Makgadikgadi Basin had thus far been investigated. Initial exploration of this area was carried out by the Botswana Geological Survey in the Nata River delta. Later investigations were carried out by Makgadikgadi Soda Ltd. under prospecting license. The better brines were determined to be in the northwestern part of the Sua Pan, rather than in the Nata delta. A 900-square-kilometer area was delineated as potentially commercial brine. Sampling revealed a homogenous brine that could yield soda ash, common salt, salt cake (Na_2SO_4), and potash (KCL). The total quantity of brine in the northern Sua Pan has been estimated at 7.2 billion cubic meters containing 140 million metric tons of soda ash and 860 million tons of common salt. The brine also contains about 0.9% sodium bicarbonate, 0.4% potassium chloride, and 1% salt cake, and is 84% water. Pilot tests have indicated that all salts can be separated and extracted successfully.

MINERAL FUELS

Coal.—The Morupule Colliery, operated by Anglo American, produced over 300,000 tons per year and was expected to reach an output of about 1 million tons per year by 1980. The coal was used for electricity generation and for the needs of the Selebi-Pikwe mine. At Morupule, the coal reserves were in two main seams; the upper seam was 18 feet thick and was separated by about 70 feet of sandstone from the lower seam, which was 8 feet thick. Reserves were given as 4 billion metric tons of proven reserves, plus an additional 13 billion tons of indicated reserves[9]. Shell Coal Botswana was actively exploring for additional resources. The coal occured mainly in eastern Botswana in Karoo sediments of Late Carboniferous to Jurassic age. Coal has also been discovered in western Botswana near the Namibian border. Botswana's large coal resources were estimated at 40 billion tons. Several geological investigations were expected to be conducted over the next 3 years in central Botswana to determine the continuation of Karoo sediments and coal in these areas. Botswana coal was classified as steam coal having a medium heat content, a medium ash content, and a low sulfur content. No coal was exported, owing to a lack of bulk loading facilities. During 1979, a mission from the Japanese Ministry of International Trade and Industry visited both the Morupule and Mmamabula coal fields to determine the potential for both buying and developing Botswana's coal. The Government was considering plans for construction of a coal-liquefaction plant to manufacture gasoline for local use.

Petroleum.—Construction began in December 1978 on two oil-storage depots at Francistown and Gaborone that were designed to give Botswana a 3-month supply of oil in case imports are interrupted. West Germany was financing the construction costs, and the stocking costs were to be partly financed by the Botswana Government and private oil companies (BP Botswana, Shell Botswana, Caltex Oil, Mobil Oil Botswana, and Total South Africa). Petroleum product imports for the period from January to September 1978 were valued at

$21.9 million.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Botswana pula (P) to U.S. dollars at the rate of P1 = US$1.21.

[3] Jeune Afrique (Paris). New Mining Investments Policy. No. 934, Nov. 22, 1978, p. 101.

[4] U.S. House of Representatives. Congressional Record. Sept. 19, 1979, pp. H 8202-H 8203.

[5] International Financial Statistics, Botswana. V. 32, No. 4, April 1980, pp. 88-89.

[6] Manos, A. Industrial Minerals of Botswana. Ind. Miner. No. 130, July 1978, p. 52.

[7] De Beers Consolidated Mines Ltd. Annual Report to December 31, 1978, 91st Annual Report. 1979. pp. 12-24.

[8] Lampietti, F.M., and Sutherland, D. Prospection for Diamonds - Some Current Aspects. Min. Mag. (London). August 1978. pp. 117-123.

[9] U.S. Embassy, Gaborone, Botswana. State Department Telegram 02509, July 23, 1979, p 1.

The Mineral Industry of Brazil

By Orlando Martino[1]

Brazil's economy in real terms grew by 6.3% in 1978 and 6.5% in 1979 compared with the 4.7% rate in 1977. The gross domestic product (GDP) in current prices increased to $191 billion[2] in 1978 and an estimated $213 billion in 1979. The rate of inflation in 1978 was 41%, the level of recent years, but increased to 77% in 1979, the highest rate since 1964.

The Government was developing policies to reduce the trade deficit that surged in 1979 by limiting imports and to reduce inflation by restraining the spending by Brazil's many public companies. At yearend 1979, it was not apparent how these policies would affect the priorities and investment programs in the mineral sector.

In the 5-year period ending in 1978, Brazil's mineral industry experienced strong growth, increasing at an average of 26% per year. In 1978 the value of mineral output increased 38% to $4.0 billion compared with $2.9 billion in 1977. The value of mineral output is estimated at $4.8 billion for 1979.

The contribution of Brazil's mineral industry to the national economy is estimated at about 2% GDP but the industry is more important in Brazil's exports. Exports of commodities with mineral origin accounted for 18% of total export value in 1978. The value of iron ore exports alone in 1978 was 8% of the total.

Brazil in 1978-79 continued as an important producer and exporter of iron ore, manganese, pyrochlore concentrate and ferrocolumbium, electronic-grade quartz crystal, and gem stones. The leading mineral commodities produced in terms of value were petroleum, iron ore, crushed stone, limestone, coal, marine salt, manganese, bauxite, gold, pyrochlore, tin, and natural gas. Brazil's metallic and nonmetallic industries comprise about 116 companies with total assets of about $3.6 billion. In terms of capital, the dominant mineral company was Companhia Vale do Rio Doce (CVRD), a corporation under the jurisidiction of the Ministry of Mines and Energy, followed by Samarco Mineração S/A, Amazonia Mineração S/A, Mineração Rio do Norte S/A, and Mineração Morro Velho S/A. The mineral fuels sector was dominated by the state-owned oil company Petroleo Brasileiro S/A (PETROBRAS).

It is estimated that 80% of Brazil's mineral industry is controlled by the state; 15%, by foreign companies; and only 5%, by private domestic companies. The Government was studying measures to increase the participation of Brazil's private sector in its mineral development. Toward this end, the Ministry of Mines and Energy reactivated in April 1979 the Conselho Superior de Mineração created in 1965. It was decided that no state company could request an exploration license (other than for petroleum or uranium under monopoly control) without having consulted private companies. It was also decided to restrict the future operations of CVRD. In the Serra dos Carajas region, for example, CVRD would be required to limit itself to iron ore exploration while private initiative would be applied in the exploration of copper, gold, lead, zinc, and manganese. As another example, the Government was considering reducing CVRD's 60% ownership in the Valesul aluminum project to 40%. The Ministry of Mines and Energy also announced that fertilizers would be the next group in which state participation would be reduced.

As a first step in reducing state ownership of industry, the Brazilian National

Development Bank (BNDE) announced in mid-1979 its plans to sell to the Brazilian private sector 7 out of 228 firms in which the Government has significant stock. The first group included the copper companies Caraiba Metais S/A and Brasileira de Cobre S/A. Caraiba Metais S/A is a subsidiary of Insumos Basicos S/A - Financiamento e Participações (FIBASE), an agency of BNDE.

Brazil continued its significant program of investments in the mineral sector. It was estimated that the funds invested in 1978 for exploration, mining, beneficiation, facilities, and metallurgical research would quadruple by the end of the period 1979-80. During 1978, the highest amount invested was in iron ore followed in order by limestone, gold, fertilizers, copper, aluminum, and coal. For the period 1979-80, investment funds would be devoted to iron ore - 31%, aluminum-bauxite - 29%, copper - 13%, nickel - 8%, and fertilizers - 6%. During 1979 about 30 projects were being implemented in mining and metallurgy.

Significant progress continued to be made in Brazil's active nonferrous development program. Especially notable was the startup of the Trombetas bauxite project in 1979, the implementation of the Caraiba copper project, and the attainment of self-sufficiency in electrolytic nickel. In other mineral sectors, Brazil continued to expand its steel-making capacity as well as its production and exports of ferroalloys. During 1978-79 Brazil also increased the number of producers of phosphate rock and greatly augmented the country's fertilizer capacity. The Conselho Nacional de Nao-Ferrosos e Siderurgia (CONSIDER) projected that $2.6 billion would be invested before 1985 for projects already approved in the nonferrous plan or for projects with funds committed.

Data from the Departamento Nacional da Produção Mineral (DNPM) of the Ministry of Mines and Energy indicated substantial increases in the measured reserves of titanium (anatase) - 430%, pyrochlore - 300%, copper - 180%, beryllium - 160%, lithium - 130%, uranium - 130%, iron ore - 40%, and gold - 36% as well as a number of nonmetallic ores. Measured reserve figures published by DNPM are those which are officially approved by the Government on the basis of annual mine reports (Relatorios Anuais de Lavras - RAL) and final reports on exploration work.

PRODUCTION

Preliminary data on production of mineral commodities for 1978 is given in table 1 with provisional or estimated data for 1979. Output of iron ore recovered in 1978-79 from the depressed level of 1977 but fell short of the peak year of 1976. There was also improvement in the output of manganese ore. Strong growth continued in the production of steel and ferroalloys. Startup of the Trombetas project was the cause for a historic high in 1979 in the production of bauxite. Advances continued in Brazil's nonferrous program especially in the metals aluminum, tin, and zinc.

Among the mineral fuels, output of coal reached new levels, and output of natural gas in 1978 was higher than in the previous year. The downward trend in the production of crude petroleum was reversed in 1979 but was below the 1974 peak.

DNPM reported that 70,000 persons were employed in the mining sector in 1978 mostly in the States of Minas Gerais - 36%, Santa Catarina - 12%, São Paulo - 10%, and Bahia - 7%. The mineral commodities absorbing the greatest labor were iron ore - 16%, coal - 14%, limestone - 11%, mineral water - 7%, gold - 6%, and tin (cassiterite) - 4%. The labor force of PETROBRAS totaled 60,700.

Table 1.—Brazil: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Bauxite, dry basis, gross weight	826,715	1,119,510	1,160,000	2,400,000
Alumina	303,000	372,000	390,000	410,000
Metal, primary	139,175	167,100	186,365	239,500

See footnotes at end of table.

Table 1.—Brazil: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS —Continued				
Antimony, metal content	35	336	253	255
Beryllium: Beryl concentrate, gross weight	368	450	739	725
Chromium:				
Crude ore	886,514	683,147	957,798	1,000,000
Concentrate	[r]186,106	310,000	330,900	400,000
Columbium-tantalum ores and concentrates, gross weight:				
Columbite and tantalite	198	107	203	275
Djalmaite concentrate	24	19	19	20
Pyrochlore concentrate	19,003	15,613	17,877	19,650
Copper:				
Mine output, metal content	54	25	--	5,000
Metal, secondary	51,820	49,060	43,200	50,000
Gold:				
Mine output troy ounces	119,536	121,048	131,368	141,500
Garimpos (prospectors)[2] do	119,984	158,472	172,742	198,700
Total do	239,520	279,520	304,110	340,200
Iron and steel:				
Ore and concentrate (salable) thousand tons	94,087	82,001	89,984	87,400
Metal:				
Pig iron do	[r]8,432	9,739	10,331	[3]10,920
Ferroalloys, electric-furnace:				
Ferrochromium	59,730	65,969	62,170	85,000
Ferrocolumbium	10,010	6,809	8,485	13,500
Ferromanganese	98,738	128,922	117,843	140,000
Ferronickel	9,971	10,860	10,976	11,100
Ferrosilicon	45,252	60,296	62,874	67,300
Ferrosilicochrome	5,880	4,121	4,698	7,900
Ferrosilicomanganese	63,843	75,108	106,249	141,000
Other and unspecified	14,634	19,172	24,518	34,000
Total	308,058	371,257	397,813	499,800
Steel, crude, excluding castings thousand tons	9,169	11,164	12,107	[3]13,893
Semimanufactures, flat and nonflat do	7,018	8,412	10,126	11,600
Lead:				
Mine output, metal content	22,615	24,039	24,000	24,000
Metal:				
Primary	43,672	48,303	49,000	50,000
Secondary	28,500	30,000	31,000	31,000
Manganese ore and concentrate (marketable), gross weight	1,696,200	1,515,673	1,650,000	1,700,000
Nickel:				
Mine output, metal content	5,273	4,241	3,560	3,900
Ferronickel, Ni content	2,149	2,530	2,550	2,360
Rare-earth metals: Monazite concentrate, gross weight	1,610	2,441	2,480	2,400
Silver[4] thousand troy ounces	[r]438	372	506	510
Tin:				
Mine output, metal content	[r]5,388	6,450	6,980	8,000
Metal, smelter, primary	[r]6,252	7,428	7,150	8,000
Titanium concentrates, gross weight:				
Ilmenite	14,615	13,268	20,077	18,200
Rutile	51	128	365	360
Tungsten, mine output, metal content	[r]962	1,212	1,160	1,360
Zinc:				
Concentrate and salable ore	183,209	205,671	[e]210,000	220,000
Mine output, metal content	69,629	81,202	[e]81,600	80,000
Metal, smelter:				
Primary	43,154	47,537	57,000	87,000
Secondary	7,000	9,500	12,000	13,000
Zirconium: Zircon concentrate, gross weight[5]	3,058	4,649	4,301	4,500
NONMETALS				
Asbestos, fiber	92,703	92,773	122,815	120,000
Barite:				
Crude	51,238	39,575	238,251	245,000
Beneficiated	25,887	39,353	87,145	90,700
Calcite	13,397	6,236	18,467	19,000
Cement, hydraulic, including pozzolanic thousand tons	19,147	21,123	22,100	24,300
Clays:				
Bentonite	143,218	108,395	167,614	172,000
Kaolin:				
Crude	710,254	939,666	1,595,482	1,657,000
Beneficiated	209,704	259,836	1,155,231	1,200,000
Kyanite	256	110	1,360	1,360
Other:				
Crude	3,229,053	3,514,219	4,457,220	4,500,000
Beneficiated	1,458,139	1,574,765	1,132,666	1,200,000

See footnotes at end of table.

Table 1.—Brazil: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Diamond:				
Gem[e] thousand carats	38	33	43	45
Industrial[e] do	38	32	43	45
Total do	76	65	86	90
Diatomite:				
Crude	5,036	11,204	32,940	33,600
Beneficiated and marketable	4,533	9,559	24,000	24,500
Feldspar and related materials:				
Feldspar, crude	[r]84,134	96,187	97,000	100,000
Leucite	10,290	10,671	9,438	10,000
Sodalite	643	982	687	7,000
Total	95,067	107,840	107,125	117,000
Fluorspar:				
Direct-shipping ore (sales)	55	13,162	NA	NA
Beneficiated product (output)	31,105	53,483	61,335	NA
Total	31,160	66,645	61,335	69,850
Graphite, all grades	6,018	9,187	10,357	11,000
Gypsum and anhydrite, crude	545,463	543,046	474,732	544,300
Lime, hydrated, and quicklime[e] thousand tons	[r]4,300	4,500	4,500	4,500
Lithium minerals:				
Amblygonite	185	489	444	454
Lepidolite	1,332	579	525	544
Petalite	968	1,028	933	998
Spodumene	413	112	102	102
Total	2,898	2,208	2,004	2,098
Magnesite:				
Crude	414,612	481,154	409,936	410,000
Beneficiated	195,877	205,719	217,270	217,000
Mica, all grades[6]	2,799	1,955	3,200	2,800
Nitrogen, N content of ammonia	144,200	145,500	202,900	225,000
Phosphate rock, including apatite:				
Crude:				
Gross weight	3,256,042	3,424,939	5,966,811	6,500,000
P_2O_5 content	[r]173,404	199,000	347,000	380,000
Beneficiated, gross weight	489,617	650,486	1,023,000	1,500,000
Pigments, mineral, crude: Ocher	5,957	6,630	6,700	7,000
Precious and semiprecious stones, except diamond, crude and worked:[6]				
Agate kilograms	1,929,158	1,346,803	1,770,868	NA
Amethyst do	182,324	202,338	357,309	NA
Aquamarine do	559	1,179	2,475	NA
Cat's-eye do	([7])	12	68	NA
Citrine do	24,250	33,830	49,656	NA
Emerald do	2,991	2,266	16,717	NA
Garnet do	211	177	2,900	NA
Opal do	513	342	617	NA
Ruby value	$403	$5,500	$505	NA
Sapphire kilograms	([8])	--	1	NA
Topaz do	4,743	3,850	4,196	NA
Tourmaline do	2,838	526	2,506	NA
Turquoise value	$80	$4,221	--	NA
Other kilograms	742,433	524,602	482,684	NA
Quartz crystal, all grades[8]	[r]2,038	1,609	1,610	1,600
Salt, marine thousand tons	2,473	2,481	2,727	2,800
Silica (silex)	3,620	3,594	5,721	5,000
Sodium compounds:				
Caustic soda	257,016	343,000	480,000	500,000
Soda ash, manufactured (barilla)	150,012	141,022	[e]159,000	163,000
Stone, sand and gravel:				
Dimension stone:				
Granite thousand tons	56,077	51,815	98,384	95,000
Marble, rough-cut	105,240	145,257	160,229	165,000
Slate	1,337	4,670	NA	NA
Crushed and broken stone:				
Dolomite thousand tons	1,599	1,663	1,092	1,500
Limestone do	34,883	39,303	46,283	47,000
Quartz[9]	34,821	45,530	95,720	95,000
Quartzite:				
Crude	276,036	255,247	212,066	250,000
Processed[10]	149,261	148,304	109,497	145,000
Shale	326,925	529,449	540,381	545,000
Sand thousand tons	3,833	4,875	NA	5,000

See footnotes at end of table.

Table 1.—Brazil: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Sulfur, elemental, byproduct	29,864	44,351	54,000	55,000
Talc and related materials:				
Talc, beneficiated and salable direct-shipping	141,035	180,474	[e]175,000	180,000
Pyrophyllite	74,094	79,284	70,729	75,000
Other: Agalmatolite	53,241	85,291	66,652	63,000
Vermiculite	946	6,833	19,611	20,000
MINERAL FUELS AND RELATED MATERIALS				
Carbon black[e]	103,000	110,000	NA	NA
Coal, bituminous (marketable) thousand tons	3,310	3,647	[e]3,860	4,000
Coke, metallurgical, all types do	2,805	3,349	3,417	3,500
Gas, natural:				
Gross million cubic feet	57,909	63,835	68,263	73,700
Marketed do	26,052	37,311	40,074	43,000
Natural gas liquids thousand 42-gallon barrels	1,906	2,050	2,088	2,100
Petroleum:				
Crude do	62,932	58,684	58,527	58,000
Refinery products:				
Gasoline do	90,013	82,692	89,944	[3]104,097
Jet fuel do	11,152	11,252	15,028	
Kerosine do	4,264	4,522	6,040	[3]19,292
Distillate fuel oil do	87,737	96,624	106,927	[3]106,910
Residual fuel oil do	98,725	101,800	102,959	[3]108,920
Lubricants do	2,252	2,378	3,664	3,700
Other do	44,546	48,898	52,003	49,000
Refinery fuel and losses do	9,705	9,774	9,000	10,000
Total do	348,394	357,940	385,565	401,919

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, molybdenite and bismuth are produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] Represents total estimated production, including the amount reported as sold by the Garimpos to Government agencies.

[3] Reported figure.

[4] Smelter and/or refined metal.

[5] Includes baddeleyite-caldasite.

[6] Exports.

[7] Revised to none.

[8] Less than 1/2 unit.

[9] Apparently includes crude quartz used to produce quartz crystal (listed separately in this table) as well as additional unreported quantities of common quartz.

[10] Produced from a portion of the crude quartzite listed above; crude quartzite processed was as follows, in metric tons: 1976-206,036; 1977-157,531; 1978—NA; and 1979—NA.

TRADE

In January 1979 the National Monetary Council adopted resolutions to initiate a significant liberalization of the Brazilian trade system. The principal decision was to phase out certain export subsidies and the 360-day 100% import deposit requirement. At the same time the Government intended to accelerate the pace of exchange rate adjustments while continuing the crawling peg system. However, in December 1979 a "maxi-devaluation" of 30% was announced, a deviation from the crawling peg exchange rate system for the first time in over 10 years, giving a total devaluation in 1979 of 103%.

After achieving an overall trade balance in 1977, Brazil had a trade deficit in 1978 of $1.0 billion that increased to $2.7 billion in 1979. Although total exports increased in value from $12.7 billion in 1978 to $15.2 billion in 1979, imports grew to a greater extent from $13.7 billion in 1978 to $18.0 billion in 1979. Oil and other fuel imports increased in value by over 50% from $4.5 billion in 1978 to $6.9 billion in 1979. In spite of the deficits in 1978 and 1979 the World Bank projects a trade surplus of almost $5 billion for Brazil by 1985. Manufactured goods are expected to become the leading export sector growing from 24% of Brazil's total exports in 1976 to 37% of exports in 1985. This growth in Brazil's output of manufactures will place a strong demand on the country's mineral industries.

According to data prepared by DNPM, the mineral sector was the principal factor in Brazil's trade deficit. Imports of commodities of mineral origin in 1978 grew 9% to $6.98 billion while exports of mineral commodities grew substantially by 40% to $2.04 billion. This gave a mineral trade deficit of $4.94 billion in 1978.

Among the exports of primary mineral commodities in 1978, the most important in terms of values were iron ore - 87.9%, manganese ore - 4.1%, gem stones - 3.3%, and columbium-tantalum concentrate - 1.7%. After a decline in 1977, iron ore export sales increased 13% to $1.028 billion in 1978 and 25% in 1979 to $1.3 billion. Exports of iron ore pellets increased fourfold in 1978. The World Bank study projects iron ore exports to increase to $2.2 billion in 1980 and $5.7 billion in 1985. This projection is based on the assumption of a recovery in world steel production and a marked increase in iron ore prices in the early 1980's. Exports of steel products in 1979 increased to $467 million, while imports of the same were $621 million.

Brazil has become an important world producer and exporter of ferroalloys. Exports of a variety of ferroalloys have increased sharply from about 21,000 tons in 1971 to about 172,000 tons in 1979. During 1979 the United State was considering the need to apply a countervailing duty against the imports of Brazilian pig iron, the production of which is concentrated in the State of Minas Gerais. In December 1979, the U.S. International Trade Commission initiated an investigation, having received advice from the U.S. Treasury Department that bounties or grants are being paid to Brazilian producers with respect to pig iron imported from Brazil, entered duty free.

As for imports of minerals and mineral-related commodities, this value in 1978 was composed of crude petroleum - 63%, nonferrous - 7%, fertilizers - 5%, and coal - 4%. Decreases in imports in 1978 were notable in ferroalloys and steel - 23%, copper - 18%, aluminum - 15%, and petroleum derivatives - 28%. Total imports from the United States in 1978 were almost 21% of Brazil's overall imports, dropping to a 17% share in 1979.

Trade between Brazil and Mainland China was expected to reach a historic level of over $200 million in 1979, compared with the $9 million of trade in 1976. Brazil would then replace Cuba as China's main trading partner in Latin America. In November 1978, a first-ever ministerial-level trade mission from Brazil visited China. Under the 5-year trade agreement signed, Brazil is to export iron ore, pig iron, and steel products in exchange for Chinese petroleum. Brazil agreed to supply China with 2.5 million tons of high-grade iron ore during 1979 and 1980 and was negotiating a long-term agreement covering the next 10 or 15 years. Brazil hoped to satisfy 15% of China's iron ore needs.

CVRD formed a new subsidiary corporation, Rio Doce America Inc., under the laws of the United States to promote the U.S. contacts of all the companies in the CVRD group.

Table 2.—Brazil: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite and concentrate	3,654	4,005	Argentina 2,435; Uruguay 1,520.
Oxide (alumina) and hydroxide[1]	145	772	Japan 307; Argentina 267; Bolivia 83.
Metal including alloys:			
Unwrought kilograms	500	2,000	All to Japan.
Semimanufactures	1,010	1,310	Panama 348; Chile 325; United States 139.
Antimony metal including alloys, all forms	1	5	All to Uruguay.
Beryllium: Beryl ore and concentrate	450	739	All to United States.
Chromium:			
Chromite	71,111	81,859	All to Japan.
Oxide and hydroxide	1	50	All to United Kingdom.
Columbium-tantalum ores and concentrates:			
Columbite[2]	57	20	United States 16; Japan 2; Netherlands 2.
Tantalite	111	112	United States 92; Netherlands 15; U.S.S.R. 5.
Pyrochlore	3,310	NA	

See footnotes at end of table.

Table 2.—Brazil: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Copper:			
Matte, including cement copper	250	1,536	West Germany 1,038; Belgium-Luxembourg 498.
Metal including alloys, all forms	1,381	3,405	United States 1,669; Colombia 678; Uruguay 407.
Gold metal, unworked or partly worked, all forms troy ounces	--	2,781	All to Paraguay.
Iron and steel:			
Ore and concentrate, including roasted pyrite thousand tons	58,541	66,371	Japan 21,512; France 4,459; West Germany 645.
Metal:			
Pig iron	850,629	1,026,479	China, mainland, 232,011; United States 183,351; West Germany 109,484.
Sponge iron, powder, shot	277	571	Uruguay 200; Argentina 175; Republic of South Africa 85.
Ferroalloys:			
Ferrochrome	46,661	42,393	Japan 23,000; United States 9,050; Canada 8,650.
Ferromanganese	33,876	40,115	United States 30,200; Netherlands 7,000; Japan 1,000.
Ferromolybdenum	115	842	Netherlands 504; Japan 154; Republic of South Africa 141.
Ferronickel	415	--	
Ferrosilicon	2,348	12,308	United States 5,140; Colombia 702; Japan 600.
Ferrocolumbium	7,052	10,852	United States 3,280; Netherlands 2,378; Japan 1,282.
Other	23,214	41,004	United States 18,902; Japan 17,661.
Total	113,681	147,514	
Steel, primary forms	113,423	332,973	Greece 155,269; Republic of Korea 72,055; United States 30,982.
Semimanufactures:			
Bars, rods, angles, shapes, sections	217,029	382,320	United States 91,144; Uruguay 36,266; Bolivia 16,329.
Universals, plates, sheets	15,494	148,868	United States 110,700; Spain 12,052; Uruguay 11,970.
Hoop and strip	651	768	Uruguay 342; Paraguay 197; Bolivia 121.
Rails and accessories	71	95	Colombia 49; Bolivia 36; Venezuela 4.
Wire	1,838	18,675	United States 3,426; Colombia 3,271; Nigeria 2,268.
Tubes, pipes, fittings	30,186	53,134	United States 27,531; Colombia 5,514; Bolivia 3,926.
Castings and forgings, rough	175	341	West Germany 86; Liberia 62; United States 56.
Lead metal including alloys, all forms	3	(3)	All to Paraguay.
Manganese:			
Ore and concentrate thousand tons	560	894	United States 159; France 129; Norway 103.
Oxides	1,090	978	Argentina 975; Bolivia 3.
Molybdenum metal including alloys, all forms kilograms	445	170	Mainly to Mexico.
Nickel metal including alloys, all forms	10	7	United States 6.
Platinum-group and silver metals including alloys:			
Platinum-group troy ounces	1,800	17,458	Spain 17,361.
Silver do	--	257	Nigeria 161; Mexico 96.
Rare-earth metals:			
Oxides	734	530	United States 302; Austria 200; United Kingdom 28.
Cerium metal including alloys	48	29	France 25; Argentina 4.
Tin metal including alloys, all forms	2,226	3,756	United States 3,302; Argentina 315.
Titanium:			
Ore and concentrate	13	--	
Oxides kilograms	105	--	
Tungsten:			
Ore and concentrate	1,354	992	Sweden 600; West Germany 200; Republic of South Africa 120.
Metal including alloys, all forms	16	25	Sweden 24.
Zinc:			
Ore and concentrate	6,128	5,688	Italy 3,000; Belgium-Luxembourg 2,688.
Oxide	22	13	Argentina 10; Bolivia 3.
Metal including alloys, all forms	44	49	Paraguay 25; Argentina 20.

See footnotes at end of table.

Table 2.—Brazil: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Other:			
Ores and concentrates	632	861	United States 849; Netherlands 12.
Ash and residue containing nonferrous metals	109	383	United States 157; Netherlands 152.
Oxides, hydroxides, peroxides of metals	1	2	All to Bolivia.
Metals including alloys, all forms:			
Pyrophoric alloys	481	593	United States 164; Belgium-Luxembourg 149; Sweden 81.
Metalloids	NA	2,201	Japan 2,047; Netherlands 55; Argentina 50.
Waste and sweepings of precious metals	56	83	United States 56; West Germany 27.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	4	1	Mainly to Uruguay and Chile.
Grinding and polishing wheels and stones	635	845	Philippines 150; Chile 128; Malaysia 85.
Asbestos	6	30	All to West Germany.
Barium, natural compounds	--	34,000	Trinidad and Tobago 28,000; Venezuela 6,000.
Boron:			
Crude natural borates	(8)	5	All to Uruguay.
Oxide and acid kilograms	235	140	Paraguay 100; Uruguay 30; Bolivia 10.
Cement	27,778	144,172	Paraguay 95,241; Bolivia 48,931.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	555	344	Bolivia 250; Chile 90.
Kaolin	11,470	21,445	Netherlands 10,250; Italy 7,050; Spain 2,350.
Other	3,864	3,231	Switzerland 1,672; Uruguay 1,150.
Products:			
Refractory (including nonclay brick)	9,748	13,941	Argentina 5,910; Poland 5,530; Uruguay 681.
Nonrefractory	25,553	40,271	Paraguay 21,715; United States 3,311; Bolivia 2,806.
Diamond, gem, not set or strung value, thousands	[4]$125	$4,412	United States $3,675; Belgium-Luxembourg $652.
Feldspar, fluorspar, etc	1,419	2,500	All to Italy.
Fertilizer materials:			
Manufactured:			
Nitrogenous	1	2,430	Uruguay 2,100; Argentina 330.
Phosphatic	450	3,358	Argentina 3,198; Paraguay 160.
Potassic	24	100	Mainly to Uruguay.
Other, including mixed	2,060	4,357	Argentina 2,700; Uruguay 1,207.
Ammonia	196	145	Uruguay 124; Paraguay 14; Chile 4; Bolivia 3.
Graphite, natural	1,133	1,026	United States 548; Argentina 228; France 102.
Gypsum and plasters	7	15	All to Trinidad and Tobago.
Lime	730	6,444	Paraguay 6,406.
Magnesite	63,788	56,219	Poland 39,380; Venezuela 5,100; Peru 4,050.
Mica:			
Crude, including splittings and waste	1,955	4,553	United Kingdom 2,352; France 1,155; United States 980.
Worked, including agglomerated splittings kilograms	127	110	United States 48; Uruguay 32; France 17.
Pigments, mineral: Iron oxides, processed	92	56	Paraguay 28; Italy 20; Bolivia 4.
Precious and semiprecious stones, except diamond, crude and worked:			
Agate kilograms	1,346,803	1,770,874	West Germany 583,146; United States 481,505.
Amethyst do	202,338	357,384	West Germany 142,971; France 57,192; United States 53,117.
Aquamarine do	1,179	2,546	West Germany 933; Japan 747; Republic of South Africa 650.
Cat's eye do	13	68	France 60; West Germany 8.
Citrine do	33,830	49,796	West Germany 23,358; France 7,223; Japan 7,003.

See footnotes at end of table.

Table 2.—Brazil: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Precious and semiprecious stones, except diamond, crude and worked —Continued			
Emerald kilograms	2,266	16,729	United States 13,017; India 2,044; West Germany 1,030.
Garnet do.	180	2,907	West Germany 2,716; United States 156.
Opal do.	342	619	United States 474; West Germany 131.
Ruby do.	([3])	1	All to United States.
Topaz do.	3,850	4,231	United States 2,798; West Germany 572.
Tourmaline do.	526	2,536	Japan 899; West Germany 787; United States 244.
Other do.	524,602	482,737	West Germany 139,585; Hong Kong 85,946; Japan 81,607.
Salt	([3])	111,684	United States 82,338; Nigeria 26,915; Benin 2,200.
Sodium and potassium compounds, n.e.s.	4,153	17,204	Argentina 7,953; Venezuela 7,776; United States 1,455.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	57,453	70,146	Italy 39,886; Japan 18,977; Spain 3,599.
Worked	7,607	2,864	Japan 1,843; United States 246; Saudi Arabia 151.
Limestone	12,999	1,110	All to Paraguay.
Dolomite, chiefly refractory grade	797	800	Paraguay 530; Argentina 270.
Quartz and quartzite	1,610	2,492	Poland 720; West Germany 690; Netherlands 371.
Sand, exluding metal bearing	996	1	Mainly to Argentina.
Gravel and crushed rock	49,502	11,230	Bolivia 9,082; Paraguay 2,148.
Sulfur:			
Elemental, colloidal	--	15	All to Bolivia.
Sulfuric acid, including oleum	400	228	Paraguay 226; Bolivia 2.
Talc, steatite, soapstone, pyrophyllite	189	159	Argentina 60; Paraguay 52; Colombia 42.
Vermiculite	45	--	
Other:			
Crude	829	8	All to Paraguay.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	6,214	5,778	Paraguay 5,184.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	3	All to Bolivia.
Carbon black kilograms	2,553	9	All to Paraguay.
Coal, all grades, including briquets	234	25	All to Argentina.
Gas, natural million cubic feet	922	1,406	Surinam 469; Paraguay 383; Argentina 290.
Hydrogen and rare gases kilograms	2,298	2,515	Uruguay 1,705; Bolivia 759; Netherlands 51.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	533	3,130	Uruguay 2,277; Argentina 853.
Refinery products:			
Gasoline, motor do.	1,572	5,118	Colombia 2,325; Nigeria 2,250; Zaire 276.
Kerosine do.	177	1,208	Nigeria 701; Zaire 349; Congo 130.
Distillate fuel oil do.	1,348	2,739	Nigeria 548; Zaire 504; Congo 500; Argentina 493.
Residual fuel oil do.	208	113	All to Congo.
Lubricants do.	14	24	West Germany 10; Paraguay 6; France 2.
Mineral jelly and wax do.	6	75	United States 53; United Kingdom 8; Mexico 6.
Other:			
Liquefied petroleum gas do.	208	250	Surinam 102; Paraguay 84; Argentina 64.
Nonlubricating oils do.	18	2	All to Paraguay and Uruguay.
Pitch do.	18	8	Argentina 6; Uruguay 2.
Bitumen and other residues do.	135	85	Paraguay 59; Bolivia 25.
Bituminous mixtures, n.e.s do.	5	6	Paraguay 4; Chile 1.
Total do.	3,704	9,628	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	757	270	Uruguay 250; Mexico 20.

NA Not available.

[1] Includes alumina gel.

[2] Includes some tantalum.

[3] Less than 1/2 unit.

[4] Quantity exported was 4,970 carats.

Table 3.—Brazil: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate	12,364	10,091	Guyana 6,491; United States 2,975; United Kingdom 625.
Oxide (alumina) and hydroxide	1,939	24,335	India 18,934; United States 4,543.
Metal including alloys:			
Scrap	8,432	22,333	United States 15,833; Norway 4,371; Canada 1,825.
Unwrought	80,819	60,327	Canada 16,653; West Germany 9,922; Surinam 6,053.
Semimanufactures	14,775	11,524	United States 7,017; West Germany 1,592; Bahrain 894.
Antimony:			
Ore and concentrate	433	654	Bolivia 616; Austria 21; Belgium-Luxembourg 17.
Metal including alloys, all forms	81	284	Mexico 180; Bolivia 90.
Arsenic:			
Trioxide, pentoxide, acids	654	601	Mexico 455; France 75; United States 39.
Metal including alloys, all forms	34	39	United States 35; Sweden 3.
Beryllium metal including alloys, all forms kilograms	--	5	Mainly from France.
Bismuth metal including alloys, all forms	NA	35	Mexico 34.
Cadmium metal including alloys, all forms	NA	55	Mexico 33; West Germany 16; Peru 6.
Chromium:			
Chromite	18,197	18,650	United States 10,000; Philippines 5,000; Republic of South Africa 3,650.
Oxide and hydroxide	371	347	Poland 160; West Germany 131; Belgium-Luxembourg 43.
Metal including alloys, all forms	60	99	United Kingdom 54; Japan 41.
Cobalt:			
Oxide and hydroxide	78	86	United Kingdom 30; Belgium-Luxembourg 28; West Germany 16.
Metal including alloys, all forms	237	312	Mainly from Belgium-Luxembourg and United Kingdom.
Copper:			
Copper sulfate	3,328	4,058	Peru 3,027; Mexico 580; Chile 385.
Metal including alloys:			
Scrap	681	1,303	United States 1,030; Kuwait 192; Canada 79.
Unwrought	182,439	156,998	Chile 120,887; Peru 22,181; Zaire 6,916.
Semimanufactures	2,162	1,673	United States 665; West Germany 459; United Kingdom 211.
Gold:			
Ore and concentrate	--	6	West Germany 4; Canada 1; United Kingdom 1.
Metal, unworked or partly worked troy ounces	NA	112,334	Switzerland 29,161; Japan 25,592; West Germany 21,862.
Iron and steel:			
Ore and concentrate	10	8	Switzerland 7.
Metal:			
Scrap	38	29	All from United States.
Sponge iron, powder, shot	6,199	7,044	United States 5,248; West Germany 1,270; Canada 255.
Ferroalloys	16,644	3,103	Japan 1,048; West Germany 600; United States 489.
Steel, primary forms	39,335	73,847	Japan 35,648; West Germany 11,815; Venezuela 9,553.
Semimanufactures:			
Bars, rods, angles, shapes, sections	41,245	29,244	United Kingdom 14,185; Japan 5,827; West Germany 5,147.
Universals, plates, sheets	651,192	437,712	Japan 114,274; France 71,906; Argentina 55,984.
Hoop and strip	36,110	11,185	West Germany 4,500; Japan 2,752; United States 1,797.
Rails and accessories	115,813	124,896	Japan 43,982; United States 35,701; United Kingdom 15,224.

See footnotes at end of table.

Table 3.—Brazil: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Semimanufactures —Continued			
Wire	8,059	4,038	Uruguay 1,480; Japan 927; United States 492.
Tubes, pipes, fittings	55,767	54,245	Japan 29,084; United States 9,964; Argentina 5,985.
Castings and forgings, rough	3,492	859	West Germany 663; Italy 78; Japan 48.
Lead:			
Ore and concentrate	42,600	44,765	United States 23,180; Argentina 8,780; Canada 5,514.
Oxides	1,669	426	Mexico 363; Peru 60; United States 2.
Metal including alloys, all forms	14,861	755	Mexico 602; Peru 140; Argentina 13.
Magnesium metal including alloys, all forms	11,222	11,504	United States 6,763; Norway 4,643.
Manganese:			
Ore and concentrate	65,997	62,277	Gabon 48,150; Mexico 10,354; United States 3,073.
Oxides	141	148	Japan 100; United States 44; Belgium-Luxembourg 4.
Metal	797	746	Republic of South Africa 425; Japan 317.
Mercury ... 76-pound flasks	4,394	4,188	Mexico 4,088; United States 95.
Molybdenum:			
Ore and concentrate	2,169	2,874	Chile 2,583; United States 265.
Metal including alloys, all forms	29	43	United States 19; West Germany 18; Netherlands 6.
Nickel:			
Ore and concentrate	17	--	
Matte, speiss, similar materials	--	302	United States 271; Australia 31.
Metal including alloys:			
Unwrought	2,309	3,017	United States 1,273; Republic of South Africa 1,146; Japan 356.
Semimanufactures	938	855	United States 244; West Germany 204; France 129.
Platinum-group metals including alloys, all forms:			
Platinum ... troy ounces	NA	3,697	West Germany 2,122; United States 739; United Kingdom 611.
Other metals, including all alloys ... thousand troy ounces	22,891	16,397	West Germany 10,803; United States 4,758; United Kingdom 611.
Rare-earth metals:			
Metals	(1)	3	NA.
Cerium oxide	30	23	United States 16; France 5.
Selenium, elemental	NA	34	Chile 16; Mexico 6; Peru 4.
Silicon metal	NA	21	Italy 20; United States 1.
Silver metal including alloys ... thousand troy ounces	42,819	6,030	Peru 2,150; Mexico 1,930; West Germany 1,187.
Sodium metal	42	22	United Kingdom 13; West Germany 9.
Tellurium, elemental ... kilograms	NA	968	Netherlands 500; Peru 330; United Kingdom 130.
Tin:			
Ore and concentrate	3,911	4,074	Bolivia 2,757; Singapore 1,310.
Oxides	132	97	United Kingdom 79; West Germany 16.
Metal including alloys, all forms	7	21	Bolivia 9; Netherlands 6; United States 4.
Titanium:			
Ore and concentrate:			
Ilmenite	69,631	56,335	All from Australia.
Rutile	2,066	4,070	Australia 3,520; Netherlands 450; Republic of South Africa 100.
Other	--	50	All from Australia.
Oxides	5,866	5,520	West Germany 4,343; United Kingdom 462; France 281.
Metal including alloys, all forms	116	73	United States 68.
Tungsten metal including alloys, all forms	27	59	Austria 25; United States 18; West Germany 9.
Uranium and thorium oxides, including rare-earth oxides, n.e.s	67	(1)	All from United States.

See footnotes at end of table.

Table 3.—Brazil: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Vanadium:			
Oxides	667	796	Switzerland 497; United States 192.
Metal including alloys, all forms	5	(1)	All from West Germany, United States, United Kingdom.
Vermiculite, including expanded	204	182	All from United States.
Zinc:			
Oxide	91	458	Uruguay 275; United States 78; West Germany 60.
Metal including alloys:			
Unwrought	58,479	67,364	Mexico 28,419; Peru 20,107; Canada 10,928.
Semimanufactures	15	21	Belgium-Luxembourg 19; West Germany 2.
Zirconium and hafnium ores and concentrates	7,640	11,194	Australia 8,625.
Other:			
Ores and concentrates	494	654	Bolivia 616; Austria 20; Belgium-Luxembourg 17.
Ash and residue containing nonferrous metals	8,892	6,245	United States 4,345; Canada 1,282; France 371.
Oxides, hydroxides, peroxides of metals	2,440	2,905	United States 737; West Germany 568; United Kingdom 331.
Metals including alloys, all forms:			
Metalloids	2,712	7,116	United States 6,865.
Alkali and alkaline-earth metals	44	26	United Kingdom 13; West Germany 9; United States 3.
Pyrophoric alloys	5	(1)	All from Switzerland.
Base metals including alloys, all forms, n.e.s	1,616	1,606	Republic of South Africa 425; Japan 358; Mexico 246.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	1,170	837	United States 529; Italy 262; West Germany 34.
Dust and powder of precious and semiprecious stones kilograms	324	416	United States 188; West Germany 160; Iceland 61.
Grinding and polishing wheels and stones	284	431	United States 190; West Germany 70; Italy 66.
Asbestos	39,198	37,651	Canada 24,441; Republic of South Africa 10,131; Italy 2,369.
Barite and witherite	165	240	United States 174; West Germany 35; United Kingdom 27.
Boron materials:			
Crude natural borates	12,591	20,247	Argentina 14,802; Peru 2,750; Netherlands 1,560.
Oxide and acid	3,710	7,333	United States 4,473; Argentina 1,315; France 547.
Bromine	NA	34	United States 33.
Cement	260,645	179,827	Uruguay 138,858; Colombia 33,472; France 5,388.
Chalk	1,523	680	France 376; Belgium-Luxembourg 250; West Germany 54.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	16,193	14,354	United States 7,817; Argentina 5,968.
Kaolin	4,096	2,453	Mainly from United States.
Other	4,752	2,160	United States 1,928; France 200.
Products:			
Refractory (including nonclay brick)	25,132	35,141	United States 12,221; United Kingdom 10,060; Argentina 7,372.
Nonrefractory	5,358	3,952	Uruguay 2,152; Spain 1,261; Italy 538.
Cryolite and chiolite	2,430	520	Mainly from Denmark.
Diamond (excluding dust):			
Gem, not set or strung value, thousands	$1,016	$2,179	Israel $897; Belgium-Luxembourg $655; United States $354.
Industrial carats	410,000	2,476	Italy 1,640; United States 386; Ireland 354.
Diatomite and other infusorial earth	2,126	1,365	Mexico 705; West Germany 490; United States 169.

See footnotes at end of table.

Table 3.—Brazil: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Feldspar and fluorspar	21	24,637	Mexico 24,630.
Fertilizer materials:			
Crude:			
Nitrogenous	44,306	45,319	All from Chile.
Phosphatic thousand tons	1,617	1,156	Morocco 432; United States 390; Tunisia 233.
Manufactured:			
Nitrogenous do	1,355	1,265	United States 872; Netherlands 171; West Germany 140.
Phosphatic:			
Thomas slag	18,530	16,900	Egypt 9,900; West Germany 7,000.
Other	500,100	353,818	United States 265,771, Portugal 41,756; Israel 24,555.
Potassic thousand tons	1,606	1,661	United States 596; Canada 454; German Democratic Republic 294.
Other, including mixed	513,401	476,874	United States 435,036; Chile 41,000.
Ammonia	220,003	224,124	United States 101,292; Mexico 93,765; Venezuela 18,718.
Graphite, natural	48	96	Madagascar 31; United Kingdom 30; West Germany 28.
Gypsum and plasters	12	958	Bolivia 946; Uruguay 10; United States 2.
Iodine	NA	166	Japan 88; Chile 77.
Lime	529	10	All from Belgium-Luxembourg.
Magnesite	109	7	United Kingdom 5; United States 2.
Mica:			
Crude, including splittings and waste	1	6	United Kingdom 3; United States 2; Italy 1.
Worked, including agglomerated splittings	70	110	United States 47; Switzerland 34; France 24.
Pigments, mineral, including processed iron oxides	2,075	2,358	West Germany 2,117; Spain 150; United States 83.
Precious and semiprecious stones, except diamond kilograms	168	228	West Germany 76; United States 74; Switzerland 72.
Pyrite, gross weight	171	108	United States 73; West Germany 30.
Salt and brines	69	15	Mainly from United Kingdom.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	277,356	43,324	United States 14,458; West Germany 8,843; Spain 7,204.
Caustic potash and sodic and potassic peroxides	3,353	2,153	West Germany 553; Italy 408; Spain 328.
Sodium carbonate (soda ash)	143,680	184,229	United States 54,275; France 36,320; Bulgaria 25,094.
Sodium sulfate	93,758	125,485	Mexico 99,089; Chile 23,800; West Germany 1,401.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	296	73	Italy 63; West Germany 10.
Other	22	23	All from Uruguay.
Worked	58	124	Italy 108; Portugal 15; Taiwan 1.
Dolomite, chiefly refractory grade	2,380	2,730	Uruguay 2,380; Italy 350.
Gravel and crushed rock	--	8	Mainly from West Germany.
Quartz and quartzite	(1)	6	Do.
Sand, excluding metal bearing	90	116	West Germany 60; Argentina 17; Belgium-Luxembourg 15.
Sulfur:			
Elemental:			
Other than colloidal	658,664	632,276	Canada 431,964; United States 63,494; Poland 56,084.
Colloidal	218	278	United States 274; West Germany 4.
Sulfur dioxide	50	27	Mainly from United States.
Sulfuric acid, including oleum	58,102	44,391	Norway 38,638; Netherlands 5,743.
Talc, steatite, soapstone, pyrophyllite	122	131	United States 105; Norway 26.

See footnotes at end of table.

Table 3.—Brazil: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Other:			
Crude	673	1,145	United States 804; Italy 150; Argentina 140.
Slag, dross, and similar waste, not metal bearing	388	674	All from West Germany.
Oxides and hydroxides of magnesium, strontium, barium	2,129	1,550	Japan 1,001; United States 205; West Germany 184.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals n.e.s	866	1,579	Uruguay 1,354; United Kingdom 123; Japan 70.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	267	597	United States 527; Argentina 70.
Carbon black and gas carbon:			
Carbon black	4,711	5,435	Argentina 1,970; West Germany 1,383; United States 928.
Gas carbon kilograms	--	250	All from United Kingdom.
Coal, all grades, including briquets thousand tons	3,563	3,740	Poland 1,392; United States 1,368; Canada 502.
Coke and semicoke do	124	1,518	West Germany 1,421.
Hydrogen and rare gases	36	38	United States 36; Canada 2.
Petroleum:			
Crude thousand 42-gallon barrels	259,469	329,852	Saudi Arabia 109,890; Iraq 97,540; Iran 42,357.
Refinery products:			
Gasoline do	705	580	Netherlands Antilles 579.
Kerosine do	([1])	37	Mainly from Venezuela.
Distillate fuel oil do	894	328	Netherlands Antilles 222; Venezuela 106.
Residual fuel oil do	403	1,088	Kuwait 656; Venezuela 310; Argentina 122.
Lubricant (including grease) do	1,967	2,056	United States 1,176; Netherlands Antilles 379; Venezuela 211.
Mineral jelly and wax do	19	8	Argentina 2; United States 2; West Germany 1.
Other:			
Liquefied petroleum gas do	2,283	923	Venezuela 572; Saudi Arabia 190; Bolivia 102.
Nonlubricating oils, n.e.s do	3,616	2,180	Saudi Arabia 1,906; United States 168; Bahamas 55.
Pitch do	3	26	Mainly from United States.
Petroleum coke do	280	997	United States 686; Argentina 272; United Kingdom 39.
Bitumen and other residues do	([1])	([1])	All from Canada.
Bituminous mixtures, n.e.s do	3	([1])	Mainly from Japan and United Kingdom.
Total do	10,173	8,223	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand tons	180	159	United States 143; Venezuela 14.

NA Not available.
[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum-Bauxite.—The major event of the period was the startup in June 1979 of the Trombetas bauxite project in the Amazon Basin in the State of Pará by Mineração Rio do Norte S/A (MRN), a consortium of domestic and foreign companies led by CVRD. Construction of the project began in April 1976 and is expected to be completed in April 1981 at an estimated cost of $423 million compared with the 1975 estimate of $260 million.

Technical assistance for the Trombetas project was provided by CVRD and Alcan Aluminio da America Latina. ALCAN was responsible for the mining, crushing, washing, and drying facilities, while CVRD was in charge of the railroad and shipping areas. The ship loader at Porto Trombetas was designed by Soros Associates, New York City, and manufactured by Italimpianti, partly in Italy and partly in Brazil.

With the initial shipment of bauxite in August 1979, Brazil became an exporter of bauxite for the first time in recent history.

Output of 2.6 million tons was projected for Trombetas in 1980, its first full year of operation. Under Phase I plans for the Trombetas project, full capacity was expected to be reached in 1982 at 3.35 million tons of bauxite. The capacity, schedule, and cost of the Phase II expansion was under study.

Engineering studies and cost estimates were completed on the Paragominas bauxite project of Mineração Vera Cruz S/A, a joint venture of the Rio Tinto Zinc Corp. and CVRD, which acquired a 36% interest in 1977. The project, located near the town of Paragominas in the State of Pará, is designed to produce 4 million tons per year of dry beneficiated bauxite. Reserves were estimated at 275 million tons of crude ore with total alumina of 56%.

According to studies by the Brazil's Ministry of Mines and Energy[3] consumption of aluminum is expected to increase from 11% to almost 15% per year during the period 1981-86. Consequently, total demand for aluminum is expected to reach 1 million tons while domestic primary supply would increase to almost 750,000. Planned expansions of current plants and new projects such as those of Valesul and Albras would not be sufficient to eliminate Brazil's dependency on imports of aluminum ingot in the foreseeable future.

Valesul Aluminio S/A (Valesul), under the control of CVRD, was expected to start up its new 87,000-ton-per-year aluminum plant in Santa Cruz, State of Rio de Janeiro, at the revised date of 1981. Valesul's $370 million project received a World Bank loan of $98 million in March 1979. Alumino Brasileiro S/A (ALBRAC) will start operations in 1983 at the initial capacity of 40,000 tons of aluminum per year, to increase to 320,000 tons by 1987.

Chromium.—Projections made by the Ministry of Mines and Energy[4] indicate that Brazil will continue to have a surplus of chromite and ferrochromium for export until 1987 when the output would be 625,000 tons and 180,000 tons, respectively. In 1978, exports of chromite (all to Japan) increased, but the c.i.f. value decreased to $4.9 million. In the same year the decreased exports of ferrochromium were valued at $14.9 million.

It appeared in 1979 that the Japanese interests would withdraw from the joint venture, Companhia de Mineração Serra da Jacobina (SERJANA), formed with Brazil's major chromite and ferrochrome producer, Cia de Ferro-Ligas da Bahia S/A (FERBASA), operating at Campo Formoso in Bahia. The greatly increased cost of shipping chromite to Japan and a planned reduction in Japanese ferrochrome capacity were given as the main reasons for the Japanese withdrawal.

The State Technological Center of Minas Gerais (CETEC) and the São Jose dos Campos Aerospace Center were attempting to develop technology to exploit uneconomic chromite reserves located in the states of Minas Gerais and Bahia. In late 1979 it was reported CETEC had located a new chromite deposit near Serro, Minas Gerais. Available geological data suggest up to 1 million tons of contained metal is present in the region.

Columbium.—During 1978 and 1979 the amount of surplus pyrochlore available for export represented about 11% of domestic production compared with the 20% surplus in 1977 and the 60% surplus in 1967. The decline in the share available for export resulted from Brazil's increased output of ferrocolumbium alloy. Production and exports of ferrocolumbium set new records in 1978 and 1979. Exports of ferrocolumbium earned $67 million in 1978 compared with $42 million in 1977.

The Brazilian Niobium Institute was established in 1979 at Lorena, São Paulo State. Supported by the Government, the Institute was to develop technology that would expand use of columbium from Brazil's extensive deposits.

Companhia Brasileira de Metalurgia e Mineração (CBMM) embarked on a major expansion program calling for a total investment of $44 million at its Araxá complex in Minas Gerais State. Annual capacity for treating pyrochlore ore was to be increased by the second quarter of 1981 to 55 million pounds of Cb_2O_5 by construction of a new mill and flotation plant. The present 32-million-pound-per-year plant would then be placed on standby. Metallurgical facilities for converting increased concentrate output to ferrocolumbium were to be expanded accordingly. In addition, columbium oxide was to be produced beginning in 1980 at a new installation having an initial annual capacity for oxide of 3 million pounds.

By the end of 1978 measured reserves of pyrochlore increased substantially to 270 million tons of ore with an average grade of 1.84% of Cb_2O_5. The new reserves at Tapira in Minas Gerais added 126 million tons of ore to the total.

Copper.—Brazil produced only secondary copper from scrap in 1978 and 1979 and continued to rely heavily on imports to meet its demand for copper. Imports of copper in 1979 were about 195,000 tons at a cost of $360 million, reflecting higher world copper prices. Brazil's dependency on foreign sources was expected to be alleviated by the mine, smelter, and refinery project of Caraiba Metais S/A, scheduled for startup in late 1981, the Camaqua mine, and the refinery project of Eluma S/A, for 1982. It is projected that capacity to produce primary and secondary copper would increase up to 465,000 tons by 1987, at which time Brazil's foreign dependency would be reduced to 26%.

The Caraiba open pit and underground mine project nearing completion is located at Fazenda Caraiba in the municipality of Jaguarari some 400 kilometers north of Salvador, Bahia. The mine was designed to produce 180,000 tons per year of copper concentrate with an initial capacity of 50,000 tons per year at startup in late 1981. The smelter-refinery under construction in the industrial complex of Camaçari near Bahia will have a maximum capacity of 150,000 tons per year of electrolytic copper with an initial capacity of 100,000 tons per year. Initially, the smelter will receive 50,000 tons per year of concentrate from the Caraiba open pit, 12,000 from Camaqua, and 8,000 from the Pedra Verde mine (Ceará State) of Minera Sul Vicosa S/A, and the balance of copper concentrate required will be imported.

General engineering for the large $783 million Caraiba project was being supplied by Milder Kaiser Engenharia S/A, a joint venture of Kaiser Engineers of the United States and a Brazilian firm.

Rio Doce Geologia e Mineração S/A (DOCEGEO), the geological exploration unit of CVRD, reported discovery of an important copper deposit near CVRD's large unexploited iron ore deposit at Carajás in the State of Pará. Information available as of yearend 1979 indicated the existence of ore bodies containing more than 1 billion tons of ore with an approximate average content of 1.0% copper and 0.4% grams of associated gold per ton. In its annual report covering 1978, DNPM reported a 180% increase in measured reserves of copper, which includes the Jaguarai deposit in Bahia and the Viçosa deposit in Ceará.

Iron Ore.—In 1979 Brazil's total installed capacity for producing beneficiated iron ore amounted to 136 million tons or 70% of Latin America's capacity. This capacity may increase to 200 million tons per year by 1985.[8] In 1978 Brazil replaced Australia as the second world producer of iron ore after the Soviet Union. CVRD maintained its position as the world's largest iron ore mining company and the largest exporter of iron ore. CVRD's iron ore output was 51.4 million tons in 1978 of itabirite and hematite and 52.9 million tons in 1979. Brazil's second largest producer, Mineração Brasileiras Reunidas S/A (MBR), shipped iron ore at a record rate of 13.4 million tons for 1978. For 1979, shipments were expected to increase further to 15.1 million tons, mostly from its Aguas Claras mine. MBR's various expansion plans were expected to lift its output to 20 million tons per year after completion.

The next important mining companies in Brazil's iron ore quadrangle, Ferteco Mineraçao S/A and S/A Mineraçao da Trindade-Samitri, produced 6.5 million tons and 4.9 million tons, respectively, in 1978. Brazil's second largest steel mill, Cia. Siderurgica Nacional (CSN), produced 2.1 million tons of iron ore in 1978. Samarco Mineraçao S/A, a joint venture of Samitri and Utah International Co., that began operating the slurry pipeline and Ponta Ubu port in 1977, produced 3.7 million tons in 1978, below its 5-million-ton capacity.

Amazonia Mineraçao S/A, a subsidiary of CVRD, made modest progress in 1978-79 in exploiting the Carajás iron ore deposit in the Amazon Basin in the State of Pará. However, in late 1979, the Government stated that the Carajás project still had priority. CVRD was preparing a special report to the Government in order to obtain the approval of the Carajás project by the Economic Development Council. A scaled-down plan was designed for a facility estimated to cost $2 billion. This cost includes a $1 billion railroad of 890 kilometers linking the deposit to the projected port complex Itaqui in Maranhao State. By the end of 1978, 80 kilometers of the railroad were completed, and an additional 200 kilometers were planned for completion in 1980. Initial exports of ore were expected to start in 1984 at a level of 15 million tons per year.

In early 1978, Minas de Serra Geral S/A, a joint venture of CVRD and an eight-member Japanese consortium led by Kawasaki Steel Corp., decided to pursue development of the Capanema iron ore mine near Ouro Preto in Minas Gerais. The $160 million project is designed to produce 10.5 million tons of ore beginning late in 1981. The project was approved by GEIMI-Grupo Ejecutivo de la Industria Minera in Brazil.

As detailed below, three new pellet plants came onstream in 1978-1979, giving Brazil a total of eight plants with a combined capacity of 24.5 million tons of iron ore pellets per year. This represented 18% of the country's ore capacity.

Pellet plant	Start-up-date	Million tons of pellets per year
CVRD I	1969	2.0
CVRD II	1973	3.0
Itabrasco	1976	3.0
Ferteco	1977	2.5
Samarco	1977	5.0
Nibrasco I	1978	3.0
Nibrasco II	1978	3.0
Hispanobras	1979	3.0
Total		24.5

In 1978, exports of pellets by Brazil increased fourfold over the 1977 level to 9.7 million tons. In 1978 Brazil was Latin America's major producer of iron ore pellets. World consumption of pellets by the steel industry has increased from 16% of the iron consumed in the West and Japan in 1967 to 26% projected for 1980.

Brazil exported about 75.4 million tons of iron ore in 1979, an 18% increase over that of 1978, at a value of about $1.3 billion. Exports of iron ore and pellets by CVRD in 1979 were valued at $754 million, 20% higher than the foreign sales of 1978. Ore shipments were mostly from the port of Tubarão followed in volume by the ports of Sepetiba and Ponta Ubu. Exports in 1978 were to Japan - 34%, Federal Republic of Germany - 22%, and France - 8%.

Domestic consumption of iron ore by Brazil's expanding steel industry grew to 12.8 million tons in 1978 and to 14.5 million tons in 1979, of which 2.15 million tons were in pellet form.

DNPM reported a 40% increase in Brazil's measured reserves of iron ore to 13.9 billion tons, with total reserves at 34.2 billion tons.

Iron and Steel.—The steel industry of Brazil continued its leading position in Latin America, accounting for 50% of the region's steel output. As a result of an ambitious steel expansion program, Brazil has moved from 20th place to 12th place among the world's steel producers. Brazil has also become a significant world producer of a large variety of ferroalloys ranking 9th after the Federal Republic of Germany.

In 1978-79 output of crude steel continued the strong growth trend of the decade, increasing 8.4% in 1978 and 14.8% in 1979. The almost 14 million tons of crude steel produced in 1979 compares with the 5 million tons in 1969. Brazil's internal demand for steel has also grown at a high rate. Total apparent steel consumption for 1979 was estimated at 13.6 million tons. In 1979, for the first time in the country's industrial history, Brazil achieved a sizable surplus of steel for export. The 1978 yearbook of the Brazilian Steel Institute listed 43 iron and steel companies in operation.

Brazil's leading steel companies, public and privately held, were engaged in expansion projects as detailed in table 4. For the first time, COSIGUA became one of the six steel companies producing more than one-half million tons of crude steel. Aços de Minas Gerais (ACOMINAS), established in early 1976 at Ouro Branco, Minas Gerais, was nearing completion of its $3 billion plant to produce 2 million tons per year of non-flat steel products. Ownership of ACOMINAS is as follows: the State of Minas Gerais - 20%, the Government-owned USIMINAS steel company - 40%, CVRD - 20%, and foreign (largely English) equipment suppliers - 20%.

Table 4.—Brazil: Major producers of crude steel

(Thousand metric tons)

Company/headquarters	1976	1977	1978	1979	Project status
Usinas Siderúrgicas de Minas Gerais S/A - USIMINAS Belo Horizonte - MG	2,345	2,721	2,709	3,100	Current capacity 3.5 million tons per year. Inaugurated Stage III expansion in August 1978. Received approval for initiation of Stage IV to increase capacity to 5.5 million tons for 1983/85.
Companhia Siderúrgica Nacional - CSN Rio De Janeiro - RJ	1,306	1,962	2,135	2,347	Engaged in $3 billion Stage III expansion program to increase capacity from 2.5 to 4.6 million tons per year by 1983. CSN's projected Stage IV would lift capacity to 6.8 million tons.

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Table 4.—Brazil: Major producers of crude steel —Continued

(Thousand metric tons)

Company/headquarters	1976	1977	1978	1979	Project status
Companhia Siderúrgica Paulista - COSIPA Rio de Janeiro - RJ	789	1,539	2,029	2,500	Engaged in $1.5 billion Stage III expansion to increase capacity from 2.5 to 3.5 million tons per year scheduled for 1982. COSIPA's two blast furnaces scheduled to be rebuilt during 1980/81. Experimenting with alcohol as reductant in blast furnaces.
Companhia Siderúrgica Belgo - Mineira Belo Horizonte - MG	793	800	835	840	Engaged in construction of new blast furnace at Monlevade plant by consortium of Pohlig - Heckel - Techint. Startup is scheduled in early 1981.
Companhia Siderúrgica Mannesmann Belo Horizonte - MG	564	601	608	NA	With current capacity at 60,000 tons per year, was planning to increase capacity for laminated products to 1.4 million tons and 200,000 tons of tubes by mid-1980.
Companhia Siderúrgica da 341 Guanabara COSIGUA Rio de Janeiro - RJ	341	422	505	700	Engaged in expansion from 545,000 to 875,000 tons per year by early 1980. COSIGUA also operated Purofer (fuel oil fired) direct-reduction plant.

The Government decided in late 1979 to begin Stage IV of the steel expansion program in USIMINAS, the country's leading producer. The Cia Aços Especiais Itabira (ACESITA) was Brazil's largest specialty steel company and responsible for the control of imports and marketing of stainless steel within Brazil. ACESITA's expansion plans call for increasing special steel output from 320,000 to 600,000 tons per year estimated to cost $600 million. Usina Siderúrgica da Bahia S/A (USIBA), Aços Finos Piratini S/A and COSIGUA operated Brazil's three direct-reduction steelmaking facilities. USIBA, which operated a HyL (Mexican designed) unit, experienced uncertainties over supplies of natural gas and prices. Brazil produced 268,400 tons of sponge iron in 1978 and 327,800 tons in 1979 and was Latin America's fourth most important producer after Mexico, Venezuela, and Argentina.

The Tubarão steel project to be located in the State of Espírito Santo near Brazil's major iron ore pelletization plants, suffered delays because of funding problems and changes in product scope. It appeared that the $2.7 billion project would remain as originally designed to produce semifinished slab steel and not be redesigned to become a fully integrated plant, capable of producing a variety of finished steel products.

Startup for the 3-million-ton-per-year plant was revised from 1980 to 1982. The Tubarão project is a joint venture of CVRD, Finsider of Italy, and 14 Japanese companies led by Kawasaki.

Ferroalloys.—The impressive growth in Brazil's diversified output of ferroalloys continued in 1978-1979. The largest increases in 1979 relative to 1978 occurred in ferrovanadium +87%, ferrotitanium +82%, ferrosilicochrome +54%, ferrosilicomanganese +45%, ferrocolumbium +36%, and ferrochromium +36%. Output decreased in ferromolybdenum and ferrosilicon. Consumption of ferroalloys by Brazil's expanding steel industry totaled 197,400 tons in 1978 and 221,000 tons in 1979, an increase of 12%.

As shown in the table below in metric tons there has been a high rate of growth of exports of ferroalloys, expecially since 1975. The value of such exports in 1979 amounted to $168 million compared with $78 million in 1976.

Year	Production	Exports	Imports
1971	127,048	20,881	23,023
1972	139,797	45,438	6,055
1973	179,011	45,967	7,405
1974	227,917	53,256	12,851
1975	256,497	58,650	7,201
1976	311,903	87,254	3,801
1977	371,251	113,576	16,482
1978	409,547	150,365	2,981
1979	475,461	172,113	NA

NA Not available.

Source: Associação Brasileira dos Produtores de ferroligas, ABRAFE Yearbook 1979, p. 17.

Manganese.—Brazil continued as one of the major world producers and exporters of manganese ore. Industria e Comercio de Minerios S/A (ICOMI), Brazil's largest producer, shipped 1,189,800 tons of manganese ore and pellets in 1979 compared with 783,300 tons in 1978. Destinations of ICOMI shipments in 1979 were as follows: Europe - 68%, Asia - 15%, North America - 15%, and South America - 2%. For 1979 ICOMI planned to invest $3 million for expansion of its manganese ore reserves with emphasis on redimensioning work at its major Serra do Navio deposits in central Amapá in the Amazon Basin, and in prospecting in the State of Mato Grosso.

Construction of a new iron and manganese mine by Mineração Corumbaense Reunida Ltda. was scheduled for completion in 1979 at Corumbá, Mato Grosso, near the Bolivian border. Annual output was expected to be 3 million tons of iron ore with an iron content of 50% to 68% and 500,000 tons of manganese ore with a metal content averaging 46%. Iron ore will be shipped from the company's own port facilities at Porto Esperança for export while manganese ore will be for domestic markets. Company ownership is divided between Brazilian and Argentine interests.

Reflecting the high rate of growth of the country's steel industry, consumption of manganese ore increased 30% to 240,000 tons. Output of ferromanganese and ferrosilicomanganese totaled 261,000 tons in 1979, a 16% increase.

Seven countries - Brazil, India, Gabon, Ghana, Upper Volta, Morocco, and Zaire (meeting in Libreville, Gabon) - declared interest in an international agreement on manganese to guarantee fair prices and to stabilize the market.

Nickel.—In 1979 the International Finance Corp. (IFC) of the World Bank Group approved financing of almost $63 million for the nickel mine and smelter project of Empresa de Desenvolvimento de Recursos Minerais "CODEMIN" S/A near Niquelandia in the State of Goiás. The project, estimated to cost almost $100 million to produce 5,000 tons per year of nickel in the form of ferronickel for sale in the domestic market, was scheduled for startup in late 1981 and full production in 1982. CODEMIN is an associated company of Brasimet, the operator of the Morro do Niquel mine at Pratapolis, Minas Gerais. Brasimet in turn is owned by Brazilian interests and the Hochschild Group. The Hochschild Group is the main sponsor of the project with 55% of the capital shares and will be responsible for the management of CODEMIN and provide the company with experienced personnel from its current mining operations in Brazil.

Also in 1979 Brazil became self-sufficient in electrolytic nickel. In the past Brazil has been essentially a producer of ferronickel for the domestic market with only small amounts available for export. Early in 1979, Companhia Niquel Tocantins (CNT), a subsidiary of the Brazilian-owned Votorantim group, initiated operation of its new electrolytic nickel plant at São Miquel Paulista in the State of São Paulo. Initial capacity of 5,000 tons per year of high-purity nickel was expected to increase to 10,000 tons per year in 1981. CNT also initiated a plant to produce basic nickel carbonate at Niquelandia, Goiás, with a capacity of 10,000 tons per year increasing to 20,000 tons per year in 1981.

The Ministry of Mines and Energy projected that, considering the new projects, Brazil would be self-sufficient in total nickel requirements (both ferronickel and electrolytic nickel) until 1982 and then become increasingly dependent on foreign sources. The overall nickel deficit in 1987 would be 44%. Electrolytic nickel alone was expected to be in surplus and available for export until 1987. On the other hand, the deficit in ferronickel was expected to increase from 1979 until 1987 when Brazil's demand would grow to 20,500 tons and supply would be only 7,300 in terms of nickel content. In 1978 the supply and demand of ferronickel were in balance. There were no exports of ferronickel in 1978 compared with the 3,838 tons exported in 1975.

Tin.—Tin production in 1978 and 1979 continued its steady rise since the depressed level of 1971. The Government was attempting to make Brazil a factor in the world tin market. Through CVRD, it was planning to pool the activities of small privately owned tin mining units operating in Roraima, Pará, and Goiás, and then centralize research and development costs, planning, and marketing. CVRD will reevaluate Brazil's tin reserves.

The Minister of Mines and Energy authorized a study of the ramifications of a reopening of the Rondonia tin district, the main producing area with the only significant mechanized operations, to "garimpeiros" (individual prospectors). About 4,000 ex-garimpeiros were reported to be unemployed and pressuring to return to the tin district.

Companhia Estanífera do Brasil (CESBRA), a Patino Group subsidiary, purchased Philipp Brothers' 50% equity in Minera Brasiliense S/A (MIBRASA) for $5 million. MIBRASA operates a washing plant at Santa Barbara and a dredge at Candeias that produces about 100 tons of tin concentrate per month. CESBRA operates the largest tin smelter in Brazil at Volta Redonda. The first bucket-wheel suction dredge to be used for mining purposes in Brazil was purchased for the Igarape Preto Mine in 1978 and began operations the following year.

In 1979 Brazil's steel industry consumed 2,241 tons of tin—a 12% increase over that of 1978—representing about 25% of national output. Exports of refined tin were valued at $22 million in 1978 while imports of tin concentrate primarily from Bolivia cost $26 million.

Titanium.—DNPM of the Ministry of Mines and Energy reported in 1978 a sharp increase of 430% in the measured reserves of titanium in the form of anatase, an alteration product of titanium minerals, which has not been discovered in commercial quantities elsewhere. The 303 million tons of ore reported are located primarily in the State of Minas Gerais in the municipality of Tapira (200 million tons) and Patrocinio (75 million tons).

Mineraçao Vale do Paranaiba S/A (VALEP), a phosphate producing subsidiary of CVRD, was developing the Tapira deposits, which consist of anatase in association with phosphate, columbium, and rare-earth minerals. The major product of VALEP's operations will be phosphate. VALEP was reportedly considering construction near the ore deposits of a $100 million first-stage plant to produce 60,000 tons per year of titanium dioxide pigment.

Titanio do Brasil S/A (TIBRAS), Brazil's only titanium pigment producer, announced plans to double production at its Bahia plant to 50,000 tons per year of pigment by 1982, which would meet Brazil's domestic demand estimated at 50,000 tons per year. Currently the country must import about 28,000 tons of pigments. In 1978 imports of the titanium mineral ilmenite, all from Australia, amounted to about 56,000 tons.

Uranium.—(Refer to Mineral Fuels)

NONMETALS

In its report covering 1978, DNPM reported substantial increases in the reserves of several nonmetallic ores: kyanite-270%, agalmatolite-148%, lithium (amblygonite)-133%, barite-114%, feldspar-55%, diatomite-50%, calcite-45%, talc-35%, and graphite-35%.

Barite.—Imco Services began producing from its processing facility in Araxá, Minas Gerais, utilizing a byproduct barite from Companhia Brasileria de Metalurgia e Mineração-CBMM, a ferrocolumbium producer.

Cement.—Brazilian cement plant programs remained active and conversion from costly fuel oil to low-quality coal challenged the industry. During 1978 there were 54 cement plants onstream and six clinker grinding stations, including the two at Itaipú Dam under construction. Gross capacity in 1978 was 24.7 million tons per year, up from 21.6 million tons in 1977 and the Sindicato Nacional da Industria do Cimento (SNIC) forecasted a capacity of 25.6 million tons per year in 1979 and 27.1 million tons in 1980. Domestic consumption of cement in 1980 was expected to rise to 28.8 million tons, requiring imports of 1.7 million tons.

Lone Star Industries Inc. and La Farge S.A., leading cement industries in the United States and France, respectively, entered into an agreement to combine their cement operations in Brazil and construct a 700,000-ton-per-year plant at Cantagalo northeast of Rio de Janeiro. The $125 million plant will be operated by Cimento Maua S/A, controlled by Companhia Nacional de Cimento Portland owned 52% by Lafarge and 48% by Lone Star.

Fertilizer Materials.—Although Brazil has embarked on an ambitious program to increase its capacity to produce phosphate rock and potash from domestic sources, it remained very dependent on foreign supplies. In 1978, imports of phosphatic, nitrogenous, and potassic fertilizers required $370 million in foreign exchange. It has been estimated by DNPM that Brazil's deficit position in production of phosphate rock will continue to decrease until 1983, but imports will remain a necessity. Domestic demand is projected to grow to 1.8 million tons of P_2O_5 in 1983 while domestic supply will expand to 1.5 million tons.

During 1978-79 Brazil increased the number of phosphate rock producers and greatly augmented the country's productive capacity. According to the Institito Brasileiro do Fosfato (IBRAFOS), five companies in 1978 had an installed capacity of 392,000 tons per year of P_2O_5, while in 1979 seven companies had an installed capacity of 790,000 tons. Quimbrasil-Quimica Industrial Brasileira S/A was producing 350,000 tons per year of 36% P_2O_5 concentrate at its phosphate mine in Cajati, São Paulo State. Quimbrasil was also the principal partner in a joint venture with CVRD for producing 600,000 tons per year of 37% P_2O_5 concentrate at the mine in Araxá, Minas Gerais. VALEP a subsidiary of CVRD (refer to item under titanium) completed its project to produce phosphate rock in October 1978 and by 1979 had an installed capacity of about 200,000 tons of P_2O_5 compared with the planned capacity of 900,000 tons of P_2O_5 per year.

Petrobrás Mineração S/A (PETROMIN) was moving forward on schedule to develop the potash deposits at Carmópolis in Sergipe State. Technical assistance was being provided by the Compagnie des Mines et Potasse d' Alsace. The $150 million project was designed to produce 500,000 tons of potassium chloride with startup in 1982.

In its report for 1978, DNPM reported 1 billion tons of phosphate rock reserves with a P_2O_5 content of 96 million tons on the basis of an average grade of 9.5% P_2O_5.

Fluorspar.—Brazil was the second most important producer of fluorspar in Latin America after Mexico; Brazil and Argentina were the principal producers in South America. The chief Brazilian producer was privately owned Mineração Santa Catarina Ltda. (Votorantim group) with a capacity of up to 40,000 tons per year of acid spar in a plant located in the Morro da Fumaça area of Santa Catarina State.

The largest measured ore reserves are in the municipalities of Morro de Fumaça and Pedras Grandes in Santa Catarina. Ore grade ranges between 35% and 88% CaF_2. DNPM reported 1.3 million tons of measured ore reserves in 1978 with a weighted average grade of 57% CaF_2.

MINERAL FUELS

Coal.—The output of coal increased substantially as efforts increased to make better use of Brazil's coal resources. Preliminary data give the following breakdown for production of marketable coal in three main producing States in southern Brazil: Santa Catarina-3,200,000 tons, Rio Grande do Sul-2,300,000, and Parana-300,000 tons. Private coal companies accounted for about two-thirds of the production in Santa Catarina and less than one-half of production in Rio Grande do Sul.

Consumption of coal in 1978 from domestic sources amounted to about 4.0 million tons, primarily for powerplants (2.5 million tons), the steel industry (973,000 tons), and the cement industry (150,000 tons). Total consumption of metallurgical coal by the steel industry in 1979 from domestic and foreign sources increased 22% to 5.17 million tons, of which 76% came from foreign sources. Coke and charcoal consumed in 1979 for steelmaking was 4.2 and 7.4 million tons, respectively. Brazil imported 4.5 million tons of coal in 1979 compared with 3.7 million tons imported in 1978.

Plans were being made by Rio Grande do Sul and Santa Catarina to quintuple coal production by 1985 under a National Coal Promotion plan governed by second priority below alcohol. On the demand side, plans call for substitution of most industrial uses of fuel oil with coal or synthetic gas also by 1985. The projected output from Rio Grande do Sul, which has 75% of Brazil's measured reserves, is 10.6 million tons of coal. Because of the high ash content of this coal, this amount of steam coal would have to be doubled to obtain the run-of-the-mine output. On this basis, the coal mine output from Rio Grande do Sul is projected at 4.3 million in 1980, about 11 million in 1982 and 23 million in 1985. Production is to be divided among the mines of the State-owned company Cia Riograndense de Mineraçao (CRM) and those of privately owned Cia de Pesquisas e Lavras Minerais (COPELMI). The 1985 output is planned to be utilized as follows: cement industry-32%, gasification plants-25%, thermal powerplants-21%, petrochemical and paper-7%, and other industries-15%.

The energy development plan of Santa Catarina also emphasizes expanded coal production but a larger relative importance is given to alcohol and to solar and wind energy. Santa Catarina's coal plans call for a production of 9.7 million tons by 1985. This target is to be achieved by operating 13 new mines: Five in the Camada Barro Bronco coal seam (with metallurgical and steam coal) and eight in the Camada Bonito seam having only steam coal.

The three southern coal States mentioned above were also planning a common coal gasification strategy based on a two-step approach: high-Btu gasification plants located at coal mine sites to supply remote industrial centers in the Center-South through gas pipelines and a system of small low to medium-Btu gasification plants to supply local energy needs.

In early 1979, PETROBRAS contracted Krupp-Koppers GmbH of Essen, Federal Republic of Germany, to design and build a coal gasification plant at São Jerônimo in Rio Grande do Sul. The $200 million plant will convert bituminous coal with a high ash and sulfur content into gas using the Koppers-Totzek process. Coal for the plant will come from CRM's Leão II mine under development which in 1985 is expected to produce 2.4 million tons. An important feature of coal from the Leão mine is its high reactivity, a fundamental factor in gasification. PETROBRAS and Cia. Siderúrgica de Santa Catarina-SIDERSUL were engaged in joint studies for a gasification plant in Santa Catarina to produce gas for SIDERSUL's proposed sponge iron plant.

The National Coal Program also calls for increased effort to more accurately define Brazil's coal reserves. Over the past 10 years, estimated coal reserves have increased from 2 billion to 22 billion tons. The major part of the reserves is suitable for underground mining. Increased drilling is programed for the Morungava coalfield, the most promising new field, and for Leño/Butia field all in Rio Grande do Sul. Brazil is considered to have the second largest coal reserves in Latin America after Colombia.[6]

Natural Gas.—The major part of natural gas produced (86%) was in association with the production of crude petroleum. Onshore oilfields accounted for 61% of the natural gas produced. Progress was made in programs to increase the capacity of the industrial sector to utilize the natural gas produced. In 1979, 223 kilometers of new gas pipelines were placed in operaton in the Northeast. Following a 16% increase in 1977, at yearend 1978, reserves of natural gas increased again by almost 13%. By yearend 1979 gas reserves increased by only 2% to 1.6 trillion cubic feet.

In October 1978, Brazil and Bolivia signed a letter of intent covering future gas sales to the industrial areas of São Paulo, via a planned 640-kilometer gas pipeline from Santa Cruz, Bolivia, to supply 400 million cubic feet per day. The amount of gas reserves needed to implement the final contract will be determined with loans from the World Bank and the Inter-American Development Bank. Bolivia's largest gas reserves are located north and northwest of Santa Cruz, an area being held in reserve to supply the planned gasline to Brazil. At the end of 1978, Bolivia's proved reserves of natural gas were estimated at 5.99 trillion cubic feet. The proposed international gas pipeline is estimated to cost $1.2 billion.

Oil Shale.—In 1979 PETROBRAS received presidential authorization to construct the first stage of a commercial oil shale plant at São Mateus do Sul in Paraná State. The basic engineering plan for the $1.5 billion plant was expected to be completed in early 1980. The National Oil Council moved the startup date forward to 1984. The plant will use the Petrosix process patented by PETROBRAS and will be operated in two phases. Initially it will produce 22,800 barrels per day of fuel oil and 450 tons per day of sulfur. In the second phase 112,000 tons per day of oil shale will be processed to extract 51,000 barrels per day of crude synthetic oil.

Petroleum.—The downtrend in the production of crude petroleum since the peak year of 1974 was reversed slightly in 1979 but provided for just 15% of Brazil's requirements. Performance of the offshore oilfields on the continental shelf compensated for the depletion of the mature onshore producing fields. The offshore oilfields offered the best possibilities for Brazil to increase its oil production. Intense development work in the offshore areas is indicated by the fact that oil production from offshore areas increased by 31% in 1979 relative to 1978. Oil produced in 1979 came from 61 onshore fields and 13 offshore fields.

Table 5 shows the breakdown in crude oil production according to the major producing area. The average output during the first semester of 1979 of 159,300 barrels per day increased to an average of 171,700 barrels per day in the second semester. The increase in offshore oil output in 1978 came especially from the Ubarana oilfield in Rio Grande do Norte and from Cacao in Espirito Santo. The sizable increase in offshore output in 1979 was due to the startup in operations of the Agulha oilfield in Rio Grande do Norte, Robalo in Sergipe and Enchova-Leste, Garoupa and Namorado in Rio de Janeiro.

Table 5.—Brazil: Crude oil production by PETROBRAS

(Thousand 42-gallon barrels)

Area	1979	
	Production	Share (percent)
Bahia	21,104	51.5
Sergipe	16,511	27.3
Rio de Janeiro	5,850	9.7
Rio Grande do Norte	3 761	6.2
Espírito Santo	2,132	3.5
Alagoas	1,076	1.8
Total	60,434	100.0
Onshore	39,671	65.6
Offshore	20,763	34.4

Source: Annual Report of PETROBRAS, 1979.

Secondary recovery projects underway by PETROBRAS in 1978 covered 19 oilfields, 16 in Bahia and 3 in Sergipe. The mature oilfields were submitted to injections of gas and/or water. The Carmópolis steam injection project was started in April 1978 and the in situ combustion project, also in Carmópolis, was started in 1979.

The changes in Brazil's consumption in the major petroleum products is shown in the tabulation below in percent.

Year	Motor gasoline	Diesel oil	Fuel oil	All products
1977	-3.8	+6.7	+2.2	+2.1
1978	+7.6	+8.1	+10.9	+8.5
1979	+3.5	+9.7	+4.1	+6.5

Alcohol mixed with motor gasoline represented almost 10% of gasoline consumed in 1978 or almost 9 million barrels of alcohol compared with 4 million barrels added to gasoline in 1977. In 1979 the National Petroleum Council increased product prices 61% or 9% in real terms.

The cost of importing crude oil and naphtha was $4.09 billion in 1978, increasing to $6.26 billion in 1979 at a cost per barrel of $12.44 and $17.11, respectively. In 1979 the volume of these imports increased 11% to 366 million barrels. Oil imports in 1978 were mostly from Saudi Arabia-33%, Iraq-30%, and Iran-13%.

Investments by PETROBRAS in the oil industry in 1978 increased 41% to $1.8 billion of which 47% was devoted to exploration and production. This share was 55% in 1979, thus emphasizing the company's policy of concentrating investments in this sector. In 1978-79 exploration activity was substantially intensified particularly in the sedimentary basins of the upper Amazon, Maranhão, Barreirinhas, Alagoas, Reconcavo, Paraná, and on the continental shelf of Foz do Amazonas, Pará-Maranhão, Piaui-Ceará, Potiguar, Bahia-Sul, Espírito Santo, Campos and Santos. By yearend 1979 Brazil's reserves of crude petroleum including natural gas liquids increased 10.6% to 1.26 billion barrels.

During 1978, nine additional service contracts with a risk clause were signed with petroleum companies bringing to 17 the total signed since inception of the program. Total investment commitments for exploration were $212 million. The third international auction for exploration areas began in October 1978. In 1979 11 additional service contracts were signed and the fourth international auction began in September.

In August 1979, PETROBRAS granted onshore exploration rights for the first time when it signed an agreement with affiliates of Royal Dutch/Shell to explore the middle Amazon region southwest of Manaus.

Alcohol Program.—PETROBRAS continued its research on the use of methyl and ethyl alcohol as an additive to motor gasoline. At its Curvelo Alcohol Plant in Minas Gerais, PETROBRAS seeks to demonstrate the feasibility of equipment and processes to check the quality of manioc obtained in the region. It was proposed to increase the level of alcohol in the gasohol blend from 20% to 25%. The National Alcohol Commission of Brazil gave permission in 1979 to export up to 500 million liters of alcohol produced from the 1979-80 harvest. Alcohol would be sold at about $50 per barrel.

Uranium-Nuclear Energy.—In December 1979 the Minister of Mines and Energy announced an increase in Brazil's total reserves of uranium officially estimated at 215,000 tons of U_3O_8, up 51% from the 142,000 tons reported by DNPM for 1978. Details on the location of the deposits were provided by Empresas Nucleares Brasileiras S/A (NUCLEBRAS) as follows:

Municipality/State	Measured/Indicated	Inferred	Total
Itatiaia - Ceará	83,000	39,500	122,500
Poços de Caldas - Minas Gerais	20,000	6,800	26,800
Figueira - Paraná	7,000	1,000	8,000
Quadrilatero Ferrifiro - Minas Gerais	5,000	10,000	15,000
Espinhares - Paraiba	5,000	5,000	10,000
Logoa Real - Bahia	3,500	23,500	27,000
Amoriópolis - Goiás	2,000	3,000	5,000
Campos Belos - Goiás	500	500	1,000
Total	126,000	89,300	215,300

The deposit at Espinhares was discovered by NUCLAN, a joint prospecting effort of NUCLEBRAS and Urangesellshaft. There appeared to be enough resources of uranium discovered to meet the projected future fuel needs of Brazil's Nuclear Power Reactor Program.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Brazilian new cruzeiros (NCr$) to U.S. dollars at the average rate of NCr$18.07=US$1.00 in 1978 and NCr$26.27=US$1.00 in 1979. On December 31, 1979, the rate was NCr$42.33=US$1.00.

[3] Ministry of Mines and Energy. Brazilian Minerals Balance. Brasilia, 1978, p. 101.

[4] Work cited in footnote 3, pp. 31, 33.

[5] Instituto Latinoamericano del Fierro y el Acero. Siderurgia Latinoamericana. No. 235, November 1979, p. 58.

[6] Instituto Latinoamericano del Fierro y el Acero. Coal Congress Report—Coal 79 Mining—Uses and Supply. April 22-26, 1979, Bogota, Colombia, p. XI.

The Mineral Industry of Bulgaria

By Tatiana Karpinsky[1]

In 1978 and 1979, the most important mineral commodities of Bulgaria were iron and steel, lead, zinc, copper, coal, crude oil, natural gas, fertilizers, cement, fluorspar, gypsum, kaolin, and certain rare elements. According to official Bulgarian sources, the country was self-sufficient in electrolytic copper, lead, and zinc, but remained deficient in crude oil, natural gas, iron ore, phosphates, and some other minerals and ores. In 1979, Bulgaria produced more than 70% of its needs in rolled steel and more than 90% of its needs in nonferrous metals and alloys. The ferrous and nonferrous metals industry, including mining, provided some 6% of Bulgaria's industrial production. In 1978, industry accounted for 55% of the national income.[2] Reportedly, the national income in 1978 increased 6%, compared with that of 1977, and reached L16,337 million.[3] In 1979, national income increased 6.5% over that of 1978.[4]

The value of Bulgaria's industrial production was reported to have increased 7% in 1978 and 7.8% in 1979, compared with that of the previous years. Labor productivity increased more than 6% each year. Capital investment in the economy totaled L5.4 billion in 1978[5] and about L6.0 billion in 1979. The production plan of the Ministry of Metallurgy and Mineral Resources for 1978 and 1979 was not fulfilled; however, total production of the Ministry increased 4.1% in 1978 and 3.7% in 1979.[6]

Major projects put into operation in 1978 included the Varna-Ilichevsk main ferryboat line, the first section of the Maritsa-East 3 electric powerplant, and the cement plant in Devnya. In 1979, the following projects were completed: The cast iron plant in Ikhtiman, the Belmeken-Obedinen coal mine, the fourth and fifth electric filters of the Zlatna Panega cement plant, and a few others.

Bulgaria's chief industrial problems continued to be labor shortages, unused production capacity in certain sectors, poor management, and poor quality of production. As a measure aimed at improving the general system for production specialization and the management structure of the Ministry of Metallurgy and Mineral Resources, the Ministry was planning to abolish the Ferrous Metallurgy DSO (State Economic Trust), the Nonferrous Metallurgy DSO, the Inert Mineral Raw Materials DSO, and a few others. Also, the following economic organizations, technical divisions, and other establishments were scheduled to be formed directly under the Ministry of Metallurgy and Mineral Resources, effective June 1, 1979:

1) The Geology Committee in Sofia;

2) The Kreminikov'tsi Metallurgical Combine in Botunets;

3) The Lenin Metallurgical Combine in Pernik;

4) The Enterprise for Steel Wire and Rod in Roman, Vratsa Okrug;

5) The Metallurgical Combine in Srednogorie, Sofia Region;

6) The Gorubso Mining Metallurgical Combine in Madan;

7) The D. Ganev Combine for the Processing of Nonferrous Metals in Sofia;

8) The Combine for Aluminum Processing in Shumen;

9) The Osogovo Mining-Dressing Enterprise in Kyustendil Okrug;

10) The Rare Metals State Trust; and a few others.

The total number of industrial workers and employees in state enterprises was 1,230,716 in 1978. The number of workers and employees in state mineral and energy enterprises, by branches, for 1978, is given in the table below.[7]

State enterprises	Workers and employees (thousands)
Fuel industry	50.8
Ferrous metallurgy (including ore mining)	32.2
Engineering and metal working industry	350.0
Production of electricity and steam heat	22.5

Bulgaria continued to participate in many multilateral investment projects on Soviet territory for the production of natural gas, petroleum, asbestos, iron ore, and other products in 1978 and 1979. Under a mutual agreement, Bulgaria is to be repaid 10 to 12 years after these projects are completed, through Soviet exports of the following products (annually): asbestos, 40,000 tons; iron ore concentrate, over 1 million tons (in terms of metal); ammonium phosphates, 26,000 tons; natural gas, almost 3 billion cubic meters; and large amounts of electric energy, oil, and other products.

Bulgaria receives Soviet assistance in developing its raw material and energy resources. The U.S.S.R. was expected to help build many large enterprises for Bulgaria's coal industry, such as the Bobov Dol Obedinen, Troyanovo-North, Troyanovo-South, and Zdravets mines. The U.S.S.R. also planned to provide scientific and technical assistance for the development of a coal basin in Dobrudja and for development of Bulgaria's copper industry.

Government Policies and Programs.—On December 1, 1978, the National Assembly approved Bulgaria's economic plan for 1980. It was drawn up along the directives outlined by the 1975 Eleventh Congress of the Bulgarian Communist Party. The plan suggested that emphasis will continue to be placed on a few favored branches of the economy, such as mining and metallurgy, chemicals, heavy machine building, and energy.

The plan for 1980 was aimed mainly at raising efficiency and quality. It called for sharply reducing the number of new projects in 1980 in order to bring old ones to completion. The plan also called for increased capacities in energy, raw materials (especially lignites), atomic power, lead and zinc ore processing, copper mining, and in a number of small projects. The plan called for an 11% increase in the production of electric and thermal power in 1980, compared with that of 1979; and an increase of 9% in 1981, compared with that of 1980. Completion of the third 440-megawatt reactor at the Kozloduy Atomic Power Station was scheduled for 1980. The plan called for completion on time of the following projects in 1980: the expanded chemical plants in Burgas and Devnya, the Elatsite ore concentrator, the plant for electric steel production in the Lenin metallurgical complex, the Shumen aluminum processing complex, the Roman steel wire and cable plant, expansion of the Varna and Maritsa East 3 power stations, and other projects.

PRODUCTION

Bulgaria's 1979 plan for overall industrial output was reportedly fulfilled. However, the plan's goals were not met for the production of pig iron, steel mineral fertilizers, coal, electric energy, and a few other commodities. In contrast to previous years, no industry in 1979 registered a production increase of more than 10%. The greatest production increase, 8.9%, was achieved by the chemical industry, although the targeted increase for that industry was 9.1%. The ferrous metallurgy and building materials industries both increased their output by 5.2%. The planned increase of 15.6% in coal production was also not met.

Development of the country's coal mining industry, which centered mainly on lignite and brown coal, continued in 1978 and 1979. About 75% of the production came from open pit mining. The Maritsa East lignite basin accounted for more than half the coal mined in 1979. Bituminous coal production was expected to increase considerably after development of the Dobrudja deposits.

In 1978 and 1979, the largest new investment project in the copper industry was the development of the Elatsita copper mine, which had a planned capacity of 10 million tons of ore per year. Development of the surface mining operation of the Assarel copper mine also began. Development of mines and modernization of production facilities in the lead-zinc industry continued, but the production of zinc increased only slightly.

In order to extend its steel industry, Bulgaria continued to renovate the Lenin and Kreminikovtsi steel complexes. An effort that was expected to make Bulgaria self-sufficient in steel production was the construction of a third complex near Burgas, which was planned to start in 1980. In 1978 and 1979, a number of U.S. firms were in contact with the Bulgarian Ministry of Metallurgy and Mineral Resources regarding the provision of equipment and technology for construction of various rolling mills at the third metallurgical complex. Electric energy generation amounted to 32.4 billion kilowatt-hours in 1979, almost 1 billion kilowatt-hours more than was generated in 1978. About 60% of the electric energy generated came from thermal electric powerplants operating on locally mined coal.

Table 1.—Bulgaria: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978^{p}	1979^{e}
METALS				
Cadmium metal, smelter^{e}	220	200	210	210
Copper:				
Mine output, metal content	57,000	57,000	60,000	63,000
Metal, primary and secondary:				
Smelter	^{r}60,000	60,000	63,000	65,000
Refined	^{r}53,000	53,000	55,000	60,000
Iron and steel:				
Iron ore:				
Gross weight thousand tons	2,316	2,270	2,453	2,100
Fe content do	748	707	785	820
Iron concentrates do	1,068	1,055	^{e}1,140	1,200
Metal:				
Pig iron do	1,558	1,614	1,493	^{e}1,450
Ferroalloys, electric-furnace, all types do	55	50	46	45
Crude steel do	2,460	2,589	2,470	^{e}2,389
Semimanufactures, rolled do	2,756	2,981	3,050	^{e}3,056
Lead:				
Mine output, metal content	110,000	117,000	117,000	117,000
Metal, smelter, primary and secondary	112,000	120,000	120,000	120,000
Manganese ore:				
Gross weight	40,000	40,000	^{e}40,000	40,000
Mn content	11,200	11,400	^{e}11,000	11,000
Molybdenum, mine output, metal content	140	150	150	150
Silver, mine output, metal content^{e} thousand troy ounces	900	840	900	920
Zinc:				
Mine output, metal content	85,500	87,000	88,000	89,000
Metal, smelter, primary and secondary	92,500	90,000	92,000	92,000
NONMETALS				
Asbestos	300	500	^{e}500	500
Cement, hydraulic thousand tons	4,362	4,065	5,148	^{e}5,400
Clays: Kaolin	194,000	194,000	199,000	199,000
Gypsum and anhydrite:				
Crude	232	295	^{e}300	300
Calcined	40	57	^{e}60	60
Lime: Quicklime thousand tons	1,599	1,725	^{e}1,800	1,825
Nitrogen, N content of ammonia	920,402	985,015	980,000	1,100,000
Pyrite, gross weight^{e}	636,000	693,000	705,000	715,000
Salt, all types	75,000	87,000	^{e}90,000	90,000
Sodium compounds, n.e.s.:				
Caustic soda thousand tons	90	100	106	115
Sodium carbonate, calcined do	1,045	1,218	1,294	^{e}1,498
Sulfur:				
S content of pyrite	280,000	305,000	310,000	315,000
Byproduct, all sources	60,000	65,000	70,000	75,000
Total	340,000	370,000	380,000	390,000
MINERAL FUELS AND RELATED MATERIALS				
Coal, marketable:				
Anthracite thousand tons	^{r}117	108	102	103
Bituminous coal do	196	186	171	173
Brown coal do	5,850	5,748	5,797	6,341
Lignite do	19,334	19,139	19,733	21,583
Total do	^{r}25,497	25,175	25,803	^{e}28,200

See footnotes at end of table.

Table 1.—Bulgaria: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coke ... thousand tons	1,408	1,446	1,411	1,400
Natural gas, marketed ... million cubic feet	1,314	365	1,140	1,140
Petroleum:				
Crude:				
As reported ... thousand tons	117	129	180	180
Converted ... thousand 42-gallon barrels	854	942	1,314	1,314
Refinery products:				
Gasoline ... do	14,280	14,450	14,620	14,700
Kerosine ... do	1,317	1,472	1,550	1,600
Distillate fuel oil ... do	22,753	23,872	24,618	24,700
Residual fuel oil ... do	33,899	35,298	36,630	36,800
Lubricants ... do	595	700	770	750
Liquefied petroleum gas ... do	545	650	754	750
Asphalt, including natural ... do	2,385	2,975	3,636	3,700
Total ... do	75,774	79,417	82,578	83,000

[e] Estimate. [p] Preliminary. [r] Revised.

[1] In addition to the commodities listed, bismuth, chromite, gold, palladium, platinum, tellurium, uranium, barite, fluorspar, magnesite, and a variety of crude construction materials (common clays, sand and gravel, dimension stone, and crushed stone) are produced, but available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

TRADE

The turnover of foreign trade (exports plus imports) in 1978 increased about 11%, compared with that of 1977. The value of exports was L6,650 million, reflecting an increase of about 10%; and the value of imports was L6,801 million, reflecting an increase of 12%.

In 1978, imports of machinery and equipment accounted for about 40% of the value of Bulgaria's total imports; and fuel, minerals, and metals accounted for about 39%. Exports of machinery and equipment comprised about 47% of the value of total exports in 1978; and fuel, minerals, and metals comprised only about 9%.[6]

In 1978, trade with centrally planned economy countries accounted for 80.1% of the country's total turnover. The U.S.S.R. was responsible for about 57% of the foreign trade turnover of Bulgaria. Deliveries of Soviet goods are of decisive significance for satisfying the import requirements of Bulgaria. Soviet deliveries covered over 57% of Bulgaria's import requirements for machinery and equipment, and the percentage of Bulgaria's import requirements that was supplied by the Soviets for other commodities was 98% of the imported coal and electric power, 93% of the oil, 87% of the coke, and 100% of the ingot steel. In 1979, foreign trade turnover increased by 11%, compared with that of 1978. The value of exports increased by 15%, and the value of imports increased by 7%.[6]

In 1979, imports of fuel, minerals, and metals accounted for 42% of the value of Bulgaria's total imports; but exports of the same group of commodities accounted for only about 13% of the total exports. Bulgaria did especially well in expanding exports to the developed market economy countries in 1979. Bulgaria asserted that in 1979 it achieved a positive balance of payments with the West for the first time.

Trade between Bulgaria and the developing countries in 1979 exceeded L1,133 million, compared with trade valued at L980 million in 1978. The bulk of this trade is carried out with India, Iraq, Iran, Lebanon, Jordan, Syria, and Turkey (among the Asian states); Algeria, Egypt, Libya, Morocco, and Nigeria (among the African states); and Brazil (among the Latin American states). In 1978, 11 of the above-mentioned countries accounted for 80% of Bulgaria's trade with the Third World countries. There were prospects that in the near future Angola, Mozambique, Ethiopia, Tanzania, Zambia, and more Latin American countries would also become regular trading partners with Bulgaria. Bulgaria's exports to the Third World countries consisted mostly of machines and equipment, technological lines, and complete plants; and Bulgaria imports from those countries ores, fuel, and other products.

Imports planned for 1980 from the U.S.S.R. included 13 million tons of crude oil and 2 million tons of petroleum products. About 2 million tons of crude oil were expected to be delivered to Bulgaria in 1980 by countries belonging to the Organization of Petroleum Exporting Countries (OPEC).

It was expected that Bulgaria's main interest in trade with the United States would continue to focus on the importation of technology that will enable the country to renovate its industrial base and increase production while using fewer raw materials.

In late 1979, Occidental Petroleum signed a 10-year agreement with Bulgaria covering possible projects for the design and construction of plastics, petrochemical, and fertilizer plants; for the development of coal production and liquefaction; for mineral exploitation; and for exploration for crude oil. The agreement could later result in production sharing, joint ventures, or service contracts. In March 1980, the president of Occidental visited Bulgaria to discuss implementation of the agreement.

It was expected that in 1980 Bulgaria would sign an agreement that would seek to speed up prospecting for nonferrous metals in the Santa Clara region of Cuba. Bulgaria was also planning to sign an agreement with Vietnam on cooperation up to 1980 in prospecting for bauxite, lead, and zinc ores.

Table 2.—Bulgaria: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum metal including alloys, unwrought	4,134	4,629	Japan 3,944; Yugoslavia 572.
Arsenic trioxide, pentoxide, acids	20	--	
Bismuth metal including alloys, all forms	10	3	All to Yugoslavia.
Cadmium metal including alloys, all forms	72	133	West Germany 63; Belgium-Luxembourg 58.
Chromium oxides and hydroxides	177	--	
Cobalt oxides and hydroxides	--	2	All to Yugoslavia.
Copper:			
Copper sulfate[2]	200	5	NA.
Metal including alloys:			
Scrap	--	293	West Germany 233; Turkey 40.
Unwrought	1,655	2,368	West Germany 1,120; Greece 535; Italy 358.
Semimanufactures	127	256	Morocco 177; Turkey 60.
Iron and steel metal:			
Scrap thousand tons	[3]61	[3]167	Greece 68; Yugoslavia 32; Italy 19.
Pig iron do.	[4]37	[4]48	West Germany 11; Greece 3.
Ferroalloys do.	[3]29	[3]24	Poland 6; West Germany 4; Hungary 3.
Steel, primary forms do.	[3]317	[3]302	Belgium-Luxembourg 87; Yugoslavia 79.
Semimanufactures:			
Angles, shapes, sections[3] do.	51	41	U.S.S.R. 13; Turkey 6; Austria 4; Cuba 4.
Bars and rods[3] do.	126	133	NA.
Heavy plates[3] do.	423	276	Yugoslavia 66; East Germany 43; Romania 40.
Sheets and tinplates[3] do.	25	16	NA.
Hoop and strip do.	15	20	Greece 19.
Wire[3] do.	24	38	NA.
Tubes, pipes, fittings do.	[4]84	[4]71	Poland 10; West Germany 4; Hungary 2.
Total do.	748	795	
Lead:			
Oxides	2,642	2,598	Yugoslavia 1,511; West Germany 401; Eygpt 255.
Metal including alloys, unwrought	12,622	13,779	Yugoslavia 7,010; Greece 2,667; Italy 1,794.
Manganese ore and concentrate	894,914	8,191	Czechoslovakia 8,000.
Molybdenum ore and concentrate	--	23	All to France.
Nickel metal including alloys:			
Scrap	163	84	West Germany 79.
Unwrought	41	176	All to Netherlands.
Semimanufactures	--	13	All to Yugoslavia.
Platinum-group metals and silver:			
Ores and concentrates value, thousands	$41	--	
Waste and sweepings do.	$289	$717	West Germany $655.
Metals, unworked or partly worked:			
Platinum-group do.	$327	$18	All to Switzerland.
Silver do.	$4,889	$2,368	All to West Germany.
Zinc:			
Oxide and peroxide	431	--	

See footnotes at end of table.

Table 2.—Bulgaria: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Zinc —Continued			
Metal including alloys:			
Scrap	--	440	Do.
Unwrought	27,335	24,737	United Kingdom 9,081; Czechoslovakia 5,000; France 2,933.
Semimanufactures	99	--	
Other:			
Ash and residue containing nonferrous metals	44	81	Italy 61.
Oxides, hydroxides, peroxides of metals	22	17	West Germany 8; United Kingdom 6.
Base metals including alloys, all forms	84	142	West Germany 69; Belgium-Luxembourg 58.
NONMETALS			
Abrasives: Grinding and polishing wheels and stones	44	1	All to Italy.
Cement[2] thousand tons	185	395	U.S.S.R. 120; Yugoslavia 79; Libya 32.
Clays and clay products:			
Crude:			
Fuller's earth and chamotte	16,564	2,330	All to Poland.
Kaolin	7,700	5,056	All to Hungary.
Other	12,483	7,958	Greece 5,925; Italy 2,033.
Products:			
Refractory	4,598	2,363	Poland 2,350.
Nonrefractory	4,454	2,603	Yugoslavia 1,688; Greece 302.
Diamond:			
Gem, not set or strung value, thousands	$173	$301	All to Yugoslavia.
Industrial do.	$198	$211	All to Belgium-Luxembourg.
Feldspar and fluorspar	--	42	All to Greece.
Fertilizer materials:			
Crude, nitrogenous[2]	7,076	5,669	U.S.S.R. 1,548; Czechoslovakia 227.
Manufactured:			
Nitrogenous[2]	792,985	713,889	Syria 68,549; India 55,216; Greece 36,246.
Phosphatic	5,142	--	
Potassic	12,130	18,413	Yugoslavia 18,286.
Ammonia	24,475	--	
Lime	26,077	20,978	All to Hungary.
Pigments, mineral: Iron oxides, processed	--	550	All to Yugoslavia.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	[4]1,300	[4]1,400	Indonesia 850.
Caustic potash	--	10	All to Cyprus.
Soda ash[2]	895,843	959,027	U.S.S.R. 365,806; Hungary 99,210.
Stone, sand and gravel:			
Dimension stone	4,803	1,246	Greece 1,160.
Gravel and crushed rock	3,308	5,545	Hungary 2,783; Poland 2,762.
Quartz and quartzite	--	42	Greece 41.
Sand	4,542	5,535	All to Greece.
Sulfur:			
Elemental, other than colloidal	11,607	--	
Sulfuric acid[2]	20,392	7,237	Romania 5,840.
Talc	--	431	Greece 407.
Other, crude	12,077	8,620	Hungary 8,177.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	--	25	Italy 23.
Coal, anthracite and bituminous thousand tons	20	[4]184	NA.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	--	549	West Germany 271; France 158.
Kerosine do.	11	4	All to Hungary.
Distillate fuel oil do.	14	685	West Germany 342; Turkey 337.
Residual fuel oil do.	1,613	1,513	Italy 1,324.
Lubricants do.	70	75	Yugoslavia 39; Netherlands 15; France 14.
Other:			
Liquefied petroleum gas do.	338	322	Yugoslavia 313.
Mineral jelly and wax do.	31	15	Yugoslavia 12.
Nonlubricating oils do.	45	--	
Bitumen and other residues do.	--	1	All to Netherlands.
Unspecified do.	98	155	All to Poland.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	4,102	6,663	Yugoslavia 2,225; Hungary 2,079.

NA Not available.

[1] Owing to the lack of official trade data published by Bulgaria, this table should not be taken as a complete presentation of Bulgaria's mineral exports. Unless otherwise specified, data are compiled from trade statistics of individual trading partners, as well as from the United Nations World Trade Annual, Walker and Co., New York.

[2] Official trade statistics of Bulgaria.

[3] United Nations. Quarterly Bulletin of Steel Statistics for Europe, New York.

[4] Statistical Yearbook of the Member States of the Council for Mutual Economic Assistance, Moscow, 1980.

Table 3.—Bulgaria: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite	32	25	All from Hungary.
Aluminum oxide and hydroxide	42	56	France 26; West Germany 20.
Metal including alloys:			
Unwrought	1,583	590	Austria 577.
Semimanufactures	7,605	8,742	West Germany 3,798; Hungary 1,450; Austria 1,176.
Antimony metal including alloys, all forms	300	585	All from Yugoslavia.
Chromium:			
Oxides and hydroxides	400	351	U.S.S.R. 350.
Metal including alloys, all forms	12	5	All from United States.
Cobalt oxide and hydroxide	--	4	All from Netherlands.
Copper:			
Ore and concentrate	[2]12,600	650	All from Italy.
Matte	--	1,015	All from Yugoslavia.
Copper sulfate[3]	9,247	7,695	All from U.S.S.R.
Metal including alloys:			
Unwrought	--	405	All from Poland.
Semimanufactures	1,549	2,862	West Germany 987; Yugoslavia 597; Austria 473.
Iron and steel:			
Ore and concentrate thousand tons	1,672	1,645	All from U.S.S.R.
Metal:			
Pig iron[3] do.	386	408	U.S.S.R. 392.
Ferroalloys do.	[4]19	[4]14	NA.
Steel, primary forms do.	[4]238	[4]401	France 66; Czechoslovakia 28.
Semimanufactures:			
Bars, rods, angles, shapes, sections do.	[4]272	[4]358	U.S.S.R. 76[5]; Italy 52; Poland 43; East Germany 40[5].
Plates and sheets[3] do.	196	193	U.S.S.R 116; France 22.
Hoop and strip[3] do.	12	7	U.S.S.R. 6.
Rails and accessories do.	[4]54	[4]60	Austria 3.
Wire do.	[4]27	[4]31	Austria 5; Italy 4; Belgium-Luxembourg 3.
Tubes, pipes, fittings do.	[4]93	[4]96	West Germay 29; Spain 8; Yugoslavia 8.
Castings and forgings do.	[4]20	[4]24	Hungary 5.
Total do.	774	769	
Lead:			
Ore and concentrate	4,772	5,100	All from Greece.
Oxides	104	--	
Metal including alloys, unwrought	400	--	
Manganese:			
Ore and concentrate	[4]95,200	[4]72,100	All from U.S.S.R.
Oxides	240	302	Greece 170; Ireland 120.
Mercury 76-pound flasks	--	348	All from Spain.
Molybdenum ore and concentrate	--	23	All from West Germany.
Nickel metal including alloys, semimanufactures	652	47	France 34; West Germany 6.
Platinum-group and silver metals, unworked or partly worked:			
Platinum-group value, thousands	$271	$255	Italy $150; Belgium-Luxembourg $67.
Silver do.	$1,356	$3,762	Switzerland $3,543.
Tin:			
Oxides	--	4	All from Austria.
Metal including alloys, unwrought	441	602	Malaysia 480[5]; Belgium-Luxembourg 120.
Titanium:			
Ore and concentrate	1,250	1,820	All from West Germany.
Oxides	1,700	1,746	Spain 1,100; Italy 370.
Tungsten metal including alloys, all forms	14	3	Mainly from Japan.
Zinc:			
Ore and concentrate	18,020	30,593	Australia 21,906; Greece 5,000.
Metal including alloys, semimanufactures	--	1	All from Belgium-Luxembourg.
Zirconium ore and concentrate	239	709	All from West Germany.
Other:			
Ores and concentrates	1,250	--	
Ash and residue containing nonferrous metals	18,780	16,248	All from Yugoslavia.
Oxides, hydroxides, peroxides of metals	19	82	West Germany 57; Belgium-Luxembourg 17.
Metalloids	715	1,613	Yugoslavia 843; France 570.
Base metals including alloys, all forms	697	211	Turkey 208.
NONMETALS			
Abrasives: Grinding and polishing wheels and stones	729	602	Austria 221; Italy 185; Yugoslavia 81; France 71.
Asbestos	2,300	2,097	All from Canada.
Boron:			
Crude natural borates	NA	4,425	All from Turkey.
Oxide and acid	NA	500	Do.
Cement thousand tons	[4]190	[4]315	U.S.S.R. 214.

See footnotes at end of table.

Table 3.—Bulgaria: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Clays and clay products:			
Crude clay, n.e.s	1,149	1,306	United Kingdom 1,191.
Products:			
Refractory	28,322	34,197	U.S.S.R. 23,041; West Germany 3,256; Greece 3,036.
Nonrefractory	229	259	Italy 204.
Diamond:			
Gem, not set or strung ---- value, thousands	$325	$566	United Kingdom $544.
Industrial ---- do	$79	$183	West Germany $160.
Diatomite and other infusorial earth	--	70	All from France.
Feldspar and fluorspar	782	142	All from West Germany.
Fertilizer materials:			
Crude, phosphatic[3] ---- thousand tons	1,399	1,457	U.S.S.R. 738; Morocco 504.
Manufactured:			
Nitrogenous	1,900	--	
Phosphatic, P_2O_5 content	[5]42,300	[5]38,500	Mainly from U.S.S.R.
Potassic, K_2O equivalent	[5]58,900	[5]38,300	Do.
Other, including mixed	35	--	
Ammonia	--	1	All from West Germany.
Lime	--	5	Do.
Magnesite	--	251	France 188; Yugoslavia 40.
Mica, all forms	5	45	West Germany 44.
Pigments, mineral: Iron oxides, processed	380	1,037	West Germany 732; Japan 305.
Precious and semiprecious stones ---- value, thousands	$55	$168	Switzerland $111; West Germany $57.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	--	241	Italy 240.
Caustic potash	309	275	Belgium-Luxembourg 255.
Soda ash	--	7	All from Austria.
Stone, sand and gravel:			
Dimension stone	116	428	Greece 373; Italy 54.
Dolomite	--	8	All from Italy.
Gravel and crushed rock	190	250	France 147; Yugoslavia 84.
Quartz and quartzite	301	416	All from Sweden.
Sulfur:			
Elemental, other than colloidal	60,075	6,045	Greece 4,500; Yugoslavia 1,545.
Sulfuric acid	--	22	United Kingdom 16; Italy 5.
Talc	--	84	West Germany 67.
Other:			
Crude	512	705	Greece 680.
Slag, dross, similar wastes	--	90	All from Italy.
Oxides and hydroxides of magnesium, barium, strontium	221	48	France 42.
Halogens	--	2	All from Japan.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black[3]	23,176	25,335	U.S.S.R. 23,898; East Germany 1,021.
Coal, anthracite and bituminous ---- thousand tons	[5]6,251	[5]6,385	Mainly from U.S.S.R.
Coke[3] ---- do	358	310	U.S.S.R. 246; Poland 28; Czechoslovakia 22.
Gas, natural[e] ---- million cubic feet	101,300	106,700	All from U.S.S.R.
Petroleum:			
Crude ---- thousand 42-gallon barrels	[5]85,870	[5]92,933	Mainly from U.S.S.R.
Refinery products:			
Gasoline ---- do	259	80	Italy 77.
Kerosine ---- do	14	10	Hungary 8.
Distillate fuel oil ---- do	31	8	Greece 7.
Residual fuel oil ---- do	13	12	Mainly from Greece.
Lubricants ---- do	31	24	Greece 5; West Germany 4; Netherlands 3.
Other:			
Liquefied petroleum gas ---- do	--	([6])	All from France.
Mineral jelly and wax ---- do	--	1	Mainly from Netherlands.
Nonlubricating oils ---- do	1	--	
Bitumen and other residues ---- do	24	24	All from Hungary.
Bituminous mixtures ---- do	--	([6])	Mainly from West Germany.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	9,753	5,932	U.S.S.R. 4,932; West Germany 777.

[e] Estimate. NA Not available.

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[1] Owing to the lack of official trade data published by Bulgaria, this table should not be taken as a complete presentation of Bulgaria's mineral imports. Unless otherwise specified, data are compiled from trade statistics of individual trading partners, as well as the United Nations World Trade Annual, Walker and Co., New York.

[2] Metallstatistik (Metallgesellschaft), 1968-1978, Druckerei C. Adelmann, Frankfurt am Main.

[3] Official trade statistics of Bulgaria.

[4] United Nations. Quarterly Bulletin of Steel Statistics for Europe, New York.

[5] Statistical Yearbook of the Member States of the Council for Mutual Economic Assistance, Moscow. 1980.

[6] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—Bulgaria is an importer of aluminum metal and aluminum alloys. Construction of the Shumen aluminum processing complex, with a projected 48,000-ton annual capacity, continued in 1978 and 1979.[10] Most of the machines and equipment for the project were delivered from the U.S.S.R., and the raw materials for the new complex were also expected to come from that country. The press section of the complex began operations in 1978 and was commissioned in 1979.[11] The press section was expected to account for 30% of the complex's overall output. Completion of the entire complex was scheduled for 1980.

Copper.—Approximately 84% of Bulgaria's copper ore is surface mined. In 1978 and 1979, most of the country's copper production came from the open pit Medet with an annual capacity of 8 million tons of ore. The rest of the country's ore came from the Chelopech underground mine, the Burgas mine, and other mines. Consumption of copper in Bulgaria was entirely satisfied by domestic production. The production of electrolytic copper was planned to increase in 1980 by 50% over that of 1975. Over L400 million was expected to be invested until 1980 to renovate the Georgi Damyanov copper plant in the town of Srednogorie and to increase the production of raw materials for the plant. The increased raw materials production was planned to be achieved mainly after completion of the Elatsite ore-dressing plant. The Elatsite complex was expected to be, upon completion, the biggest facility within Bulgaria's nonferrous metallurgy industry. It was planned to include a strip mine with a projected capacity of 10 million tons of ore per year (0.45% copper content); an ore-dressing plant; and underground ore-transport facilities, including a 7-kilometer tunnel with a conveyor belt.

Under an agreement signed in 1979 between Bulgaria and Finland, Finnish Outokumpu Ahlstrom and Rauma-Repola (AOR) was to deliver and install the Outokumpu flash-smelting technology at the Georgi Damyanov copper plant in 1981 and 1982. In 1979, Bulgaria started development of copper ore mining at Assarel.[12] The Assarel mine was included as one of the major projects of the 1981-85 5-year plant. The main target for the copper industry under that 5-year plan was to achieve a further increase in copper output by developing and putting into operation the new capacity of the Elatsite, Elshitsa-2, Lebnitsa-Zone II, Assarel, and Tsar Arsen mines and a few others.

The Ore Mining and Dressing Institute in Sofia was planning to build an underground mine and dressing plant in Vietnam for the production of copper ore. Plans were for Bulgaria to supply and install the plant's machinery. Experts from the institute were also planning to build a similar plant in Algeria.[13]

Iron and Steel.—Bulgaria's output of iron ore has been insufficient to satisfy growing domestic needs, and a large amount of iron ore has been imported almost exclusively from the U.S.S.R. Also, about 80% to 85% of Bulgaria's coke imports comes from the U.S.S.R.; the rest comes from Poland and Czechoslovakia.

In 1978 and 1979, domestic iron ore was mined mainly at the Kreminikovtsi deposits north of Sofia and was delivered to the Kreminikovtsi Metallurgical Complex. Kreminikovtsi iron ore consists of limonite (70%), siderite (18%), and hematite (12%); and reserves are estimated at 250 million tons with an iron content of about 30%. Besides iron, Kreminikovtsi iron ore deposits contain barite, manganese, lead, and—in lesser quantities—copper, zinc, and rare metals. Reportedly, new technology for the recovery and use of these metals was recently developed at the Institute of Nonferrous Metallurgy.

Production of pig iron and steel in 1979 was below the 1978 level.[14] The commissioning of the belts at the agglomeration plant of the Kreminikovtsi Metallurgical Complex was delayed as a result, the planned blast furnace production capacity was not reached, and the planned quantities of pig iron and steel were not produced.[15]

In 1980, pig iron production is planned to reach 1.8 million tons; crude steel production 2.9 million tons; rolled ferrous metals 3.4 million tons; and steel pipes 248,000 tons.[16]

Two large metallurgical complexes, the Lenin Metallurgical Complex at Pernik, commissioned in 1953, and the Kreminikovtsi complex, which started operations in 1963, were under renovation in 1978 and 1979. Total production of the Lenin and Kreminikovtsi plants was expected to reach 4 million tons per year when modernization of the steel plants is completed. The 1976-80 5-year plan provided for renovation of the first agglomeration plant at the Kreminikovtsi complex,the second blast furnace, the blooming mill, and other existing facilities, and construction of a fourth coke battery and a fourth blast furnace.[17] Electric steel furnaces with a capacity of 1 million tons per year were under construction at the Lenin plant in 1978 and 1979 and were expected to be commissioned in 1981.[18]

Construction of a third metallurgical complex with a total capacity of 4 million tons of steel per year was planned to start near the Black Sea town of Burgas in 1980. Its first stage of contruction was planned to be completed in 1985. It was expected that this complex, along with the two existing metallurgical complexes, would make Bulgaria self-sufficient in ferrous metals. The ore, coke, and part of the electric power for the new complex was expected to be imported from the U.S.S.R.[19]

In 1978 and 1979, construction work was in progress at the steel plant near Rakovsky, which was expected to produce more than 50,000 tons of castings per year for use in different industries. The first stage of the plant was scheduld to be completed in 1981, and completion of the second stage was scheduled for 1983.

Lead and Zinc.—Bulgaria has an exportable surplus of lead and zinc metals. In 1978 and 1979, annual consumption of lead was approximately 105,000 tons. Bulgaria has several mining enterprises for lead-zinc production; they are Gorubso, Madjarovo, Ustreme, Dmitrov, and a few others. About 73% of all the country's lead-zinc deposits are concentrated in the Gorubso lead-zinc ore fields in the Rhodopes region, in the vicinity of Madan and Rudozem. In 1978 and 1979, Gorubso Mining Enterprises accounted for about 86% of the country's total production of lead and for more than 90% of the total production of zinc concentrates.[20] All Bulgarian lead-zinc ores are mined by underground methods at depths of more than 400 meters below the surface. The typical minerals are galena, sphalerite, chalcopyrite, pyrite, anglesite, and marcasite. The ore of the Gorubso mines averaged approximately 1.9% lead and 1.5% zinc in 1978. Lead concentrate (70% lead) and zinc concentrate (52% zinc) were processed mainly at the Plovdiv and Kurdjali smelters. Bulgaria's planning authorities earmarked 60% of the total amount allocated for geological investigations of solid mineral resources during the 1981-90 period for nonferrous metals exploration, which includes exploration for lead-zinc ores. The 1980 plan called for renovation and expansion of the lead-zinc mines of the first, fourth, and fifth ore administrations of the Gorubso Mining Enterprise. The development plan anticipated large investigations for new lead-zinc deposits in the Osogovo and Lozen regions.[21]

Cement.—Bulgarian cement production was expected to reach 6.6 million tons in 1980. A new cement plant was underway in 1979 at Temelkovo, west of Sofia.[22] Reportedly, construction of the Devnya cement plant was completed in 1978.

Fertilizer Materials.—Consumption of nitrogen fertilizer in Bulgaria has stagnated in recent years, and extra production has been available for export. In 1978 and 1979, the main purchasers of Bulgaria's nitrogenous fertilizers were Greece, Egypt, and Syria. Urea was exported mainly to India, Egypt, and Vietnam. Ammonia plants at Dimitrograd and Stara Zagora were being renovated to enable them to use Soviet natural gas and to increase production capacities.[23]

In 1978, Denmark's Haldor Topsoe signed a $10 million contract in which the company agreed to supply Bulgaria's Vratsa complex with a 400-ton-per-day gas preparation unit for nitrogen-ammonia synthesis. The agreement called for payment in the form of products, including ammonia and urea, over a period of 7 years.

Technipetrol (Italy) signed a $16 million contract in 1978 for a 200,000-ton-per-year urea plant it was to supply for the Vratsa complex. Compensation arrangements involved the purchase of Bulgarian mechanical equipment and forklift trucks. The urea plant was being designed to utilize Snamprogetti technology and was expected to be completed by mid 1981. Orenburg gas was expected to play a major role in the expansion of nitrogen fertilizer production in Bulgaria during the 1981-85 5-year plan period.[24] The Bulgarian state corporation Bulgargeomin planned to mine phosphate rock in Angola. A cooperation agreement was signed between the two countries for mining at an initial rate of 15,000 tons of rock per year, with the output to be used for processing into fertilizers. Jordan planned to supply 500,000 tons of raw phosphate rock to Bulgaria during the 1980-82 period, according to the Jordan Phosphate Mines Co.

Marble.—Large reserves of white and gray marble have recently been discovered in the southern Pirin mountain range (Kurdjali district). They are estimated at over 2 billion cubic meters, and large-capacity quarries are expected to be developed. Production in this region was projected to reach 2 million cubic meters of marble blocks and 250,000 square meters of marble tiles by 1980. It was anticipated that part of this production will be available for export. Mineralimpex annually exports some 5,000 cubic meters of marble in blocks and about 40,000 square meters of slabs. Marble is exported to many countries,[25] including Poland, the German Democratic Republic, Czechoslovakia, Belgium-Luxembourg, Denmark, Austria, the German Federal Republic, Lebanon, and Egypt.

MINERAL FUELS

Estimated primary energy production derived from fossil fuels, hydroelectric, and nuclear generation in Bulgaria was 15.0 million tons of standard coal equivalent (SCE) in 1979, compared with 14.8 million tons of SCE in 1978. In 1979, the estimated share of coal (lignite, brown, and bituminous) in the total primary energy production was 89.3%; the share of crude oil, 2%; natural gas, 0.7%; hydroelectric power, 2.7%; and nuclear energy, 5.3%. The total consumption of primary energy increased from 48.5 million tons of SCE in 1978 to an estimated 49.9 million tons of SCE in 1979. In 1979, coal provided estimated 40.5% of the total consumption while oil represented 39.7%; natural gas, 16.2%; hydroelectric energy, 0.8%; nuclear energy, 1.6%; and imports of energy 1.2%.

Table 4.—Bulgaria: Total primary energy balance for 1978 and 1979

(Million tons of standard coal equivalent)[1]

	Total primary energy	Coal (bituminous, brown, and lignite) and coke	Crude oil and petroleum products	Natural gas	Hydroelectric power	Nuclear power	Other sources of energy
1979:[e]							
Production	15.0	13.4	0.3	0.1	0.4	0.8	--
Imports	35.0	6.8	19.5	8.0	--	--	0.7
Exports	.1	--	--	--	--	--	.1
Apparent consumption	49.9	20.2	19.8	8.1	.4	.8	.6
1978:							
Production	14.8	13.3	.3	--	.4	.8	--
Imports	33.8	6.7	18.5	8.0	--	--	.6
Exports	.1	--	--	--	--	--	.1
Apparent consumption	48.5	20.0	18.8	8.0	.4	.8	.5

[e] Estimated.

[1] 1 ton of standard coal equivalent (SCE)=7,000,000 kilocalories. Conversion factors used are as follows: Hard coal 1.0; brown coal and lignite, 0.5; crude oil, 1.47; natural gas (1,000 cubic meters), 1.33; hydroelectric and nuclear power (1,000 kilowatt-hours), 0.125.

Coal.—Production fell some 2.2 million tons short of planned output in 1978 and was 1.7 million tons short in 1979. The main reason was the continuing delay in putting new mines into operation on schedule. The U.S.S.R. and Poland supply all of Bulgaria's coal imports. In the 1978-79 period, most of the domestic coal production came from poor-quality lignite deposits in the Maritsa-Istok mines, which can be used only for thermoelectric power stations.[26] In addition to the Maritsa-Istok lignite and Pernik brown coal fields, which are gradually being depleted, Bulgaria increasingly has exploited the Bobov Dol brown coal deposits in the southwestern part of the country. These deposits have been estimated at 200 million tons, enough to supply the 450-megawatt power station built there for 50 years. New capacities of 2.4 million tons are planned to be developed in 1980, and an additional 1.2-million-ton capacity was planned for development in 1981. Emphasis was being placed on development of the following mines: Troyanovo 3, Bobov Dol, Edraveta, and Cherno More 2.

The Ministry of Power Supply made a decision to develop the new Zdravets underground mine, with a projected annual output of 2 million tons per year of cleaned coal, at the Marbas mining and power complex. Plans were for the mine to be located on the right bank of the Martinika River, about 250 meters south of Strausko Village.[27] Development of the mine was expected to take 7.5 years, and it was anticipated that another 5 years would be required to reach full projected capacity.

In the 1981-85 5-year plan period, it was anticipated that greater attention would be paid in the area of coal mining to improving the utilization of available equipment.[28]

In 1979, a decision was made to accelerate the exploration of the Dobrudja coal basin in northeastern Bulgaria. A complex program was prepared under the supervision of the Committee on Geology, the Ministry of Power Supply, and the Ministroy (Mine Construction Trust). Two experimental shafts were scheduled to be built by the end of the 1981-85 5-year period. The Dubrudja basin coal reserves are estimated at 1.2 billion tons. They lie at a depth below 1,300 meters under water-bearing formations.[29] The coal has a calorific value of about 7,000 kilocalories per kilogram, good coking qualities, and low ash and sulfur contents.

Gas.—In 1978 and 1979, despite some newly discovered gas deposits, domestic gas production continued to be insignificant. The U.S.S.R. supplied all of Bulgaria's gas imports. It was projected that 6 billion cubic meters of gas would be conveyed in 1980 through the U.S.S.R.-Bulgaria pipeline. The first stage of the Devnya-Burgas-Stara Zagora-Dimitrovgrad-Plovdiv-Sofia southern branch was near completion in 1979.

Petroleum.—Production of crude oil in Bulgaria was insignificant in 1978 and 1979. Petroleum supplies came mainly from the U.S.S.R., but were also imported from Iran and Libya. Deliveries of crude oil were estimated at about 13 million tons for 1980. The total capacity of Bulgaria's three refineries was reported to be about 14 million tons per year; approximately 11.5 million tons was processed annually in both 1978 and 1979.[30] Reportedly, Bulgaria needs about 7 million tons of petroleum products per year for its own needs. The remainder is reexported as an important source of hard currency.

The research team of the Marine Research and Oceanology Institute of Varna and specialists from Moscow University continued their geophysical research of the Black Sea shelf zone in 1979.

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[1] Foreign mineral specialist, Branch of Foreign Data.

[2] Statisticheski Godishnik na Narodna Republica Bulgariya (Statistical Yearbook of the People's Republic of Bulgaria), Sofia. 1979, p. 133.

[3] Exchange rate for the Bulgarian lev (L) for 1978: L1 = US$1.10; and for 1979: L1 = US$1.16.

[4] Rabotnichesko Delo (Labor Review), Sofia. Jan. 23, 1980, pp. 1-2.

[5] Statisticheski Izvestiya (Statistical News), Sofia. No. 2, 1979, p. 12.

[6] Work cited in footnote 4.

[7] Page 166 of work cited in footnote 2.

[8] Statisticheski Izvestiya (Statistical News), Sofia. No. 1, 1979, p. 49.

[9] Statisticheski Izvestiya (Statistical News), Sofia. No. 1, 1980, p. 14.

[10] Ikonomicheski Zhivot (Economic Life), Sofia. July 26, 1978. p. 15.

[11] Rabotnichesko Delo (Labor Review), Sofia. Sept. 19, 1979, p. 1.

[12] Rabotnichesko Delo (Labor Review), Sofia. May 9, 1979, p. 2.

[13] Bulgarian Foreign Trade, Sofia. No. 2, 1979, p. 48.

[14] Page 2 of work cited in footnote 4.

[15] Rudnichar (Miner), Sofia. Jan 3, 1980, p. 2.

[16] Rudnichar (Miner), Sofia. Sept. 6, 1979, pp. 1-2.

[17] Ikonomicheski Zhivot (Economic Life), Sofia. No. 38, Sept. 20, 1978

[18] Rabotnichesko Delo (Labor Review), Sofia. Nov. 5, 1978, p. 2.

[19] Rudnichar (Miner), Sofia. Nov. 2, 1978, pp. 1-2.

[20] Biuletyn N.T.I. Hiproruda (Bulletin of the State Institute for Designing of Ore Mines), Sofia. No. 2, 1978, pp. 5-12.

[21] Rudodobiv (Ore Mining), Sofia. No. 8, 1979, p. 3.

[22] Rabtnichesko Delo (Labor Review), Sofia. Nov. 20, 1979, p. 3.

[23] Bulgarian Foreign Trade, Sofia. No. 4, 1978, pp. 9-10.

[24] Nitrogen (London). No. 117, January-February 1979, p. 32.

[25] Bulgarian Foreign Trade, Sofia. No. 4, 1978, p. 48.

[26] Rabotnichesko Delo (Labor Review), Sofia. Oct. 12, 1979, p. 2.

[27] Rudnichar (Miner), Sofia. Dec. 14, 1978, pp. 1-3.

[28] Ikonomicheheski Misul (Economic Thought), Sofia. No. 5, 1979, pp. 108-113.

[29] Rabotnichesko Delo (Labor Review), Sofia. Dec. 2, 1977, p. 2.

[30] Vuhshna Turgoviya (Foreign Trade), Sofia. No. 4, 1979, pp. 2-4.

The Mineral Industry of Burma

By Gordon L. Kinney[1]

Burma's current mineral output was small by world standards, although Burma was a producer of some consequence before World War II and still is considered to have a good potential for expansion. Burma's major minerals included lead and zinc, which came mostly from the famed Bawdwin mine, once the richest lead-zinc lode mine in the world but now mining much lower grade material. Tin and tungsten production was important and came from a variety of small-scale placer and lode mines and few larger Government-owned mines. Burma was one of the few Southeast Asian countries to produce sufficient petroleum and natural gas to meet its domestic needs, and there was a small amount of crude oil exported in 1979. Burma also produced excellent quality jade and other gem minerals.

About 67,000 persons, or 0.5% of the active labor force, were employed in mining activities at the beginning of 1978, and 68,000 during 1979. These miners accounted for approximately 1.8% of the net output of goods and services. Burma's mineral industry was managed primarily by four state-owned corporations. The No. 1 Mining Corp. controlled the lead, zinc, and silver output, which came mostly from its Bawdwin mining operation. It will also run the Monywa copper enterprise. The No. 2 Mining Corp. ran all the major tin and tungsten operations and the Heinze dredging project. The No. 3 Mining Corp. mainly was in charge of the Kalewa and Namma coal mines and the Moulmein and Loikaw antimony mines. The industrial minerals such as barite, limestone, and gypsum were managed by the No. 4 Mining Corp. The No. 3 Corp. was given the responsibility for the planned direct-reduction steel plant in 1979.

The Government's policy in running these mines was that no foreign investment was accepted, and the mines would have no special marketing arrangements with foreign corporations or governments. As a result, very little foreign capital has been available for developing new mines or for modernizing or expanding old ones.

The Government's third 4-year plan, beginning in FY 1978-79, stated that the fullest possible utilization of natural resources was necessary in order to attain the desired economic goals. It mentioned that certain projects may require capital or technical know-how beyond the means of the state. "In such cases, mutually beneficial economic cooperation with foreign enterprises public or private will be considered for specified periods, provided they are not detrimental to the Socialist system."[2] How much of an effect this apparent change will have on the investment climate remains to be seen.

It was planned that some old mines would be reopened, and some of the operating mines would be modernized and expanded with the help of foreign aid donations and loans. Security problems near the mines have been a deterrent to large-scale foreign loans in a few cases. However, although problems still exist in some areas, others have been alleviated, and the overall security situation was somewhat improved.[3] The security situation has also been a factor in exploration for new deposits in geologically favorable areas of Burma. The detailed ground surveys and drilling needed for resources exploration and development have not been conducted in some areas. The Department of Geologic Survey and Mineral Exploration (GSE) made no major discoveries during the year. However, the GSE was expected to increase its fieldwork during 1978 and 1979, after several years of relatively low activity and expenditures.

Gross national product (GNP) for FY 1978-79 was estimated at just over $4 billion at current prices.[4] The revised figure for the previous year was $3.9 billion. GNP at constant 1969 prices was $1,807 million in FY 1977-78 and $1,825 million in FY 1978-79. The chronically high inflation rate appeared to have taken a turn for the better as the Rangoon consumer price index (1972=100) declined about 4% for the year to 246. Overall exports were reported to be $294 million and imports increased to $477 million in FY 1978-79.[5] The balance of trade reflected the increase in imports and jumped from a $70 million deficit in FY 1977-78 to a deficit of more than $180 million in FY 1978-79. The mineral sector was a small part of Burma's GNP and trade volume, and not comparable to the agricultural sector in importance.

In 1978, the weather conditions were ideal for the rice crop, the most important product of Burma's highly agricultural economy. Burma escaped the late-season floods which hit neighboring countries, and estimates indicate a record paddy harvest, possibly as high as 10 million tons versus less than 9 million tons in 1977. Rice was the major export item and foreign exchange earner and thus of extreme importance to the overall economy.

PRODUCTION

The value of the output of the mineral sector increased substantially in FY 1977-78 to nearly $80 million at current prices.[6] FY 1978-79 value data were not available, but the reported tonnages for calender year 1978 for all nonfuel minerals except jadeite increased, in some cases dramatically. This across-the-board rise in production, the first in several years, was attributable to three major factors: (1) larger overall budgetary allocations for the mining sector; (2) bilateral and multilateral economic assistance for mining, enabling the mining corporation to acquire new equipment and to utilize the available equipment more effectively; and (3) a Government program of "commercialism" for the mining companies providing the workers with better incentives.[7] The Government plan for 1979-80 targeted small increases for nearly all of the important mineral products.

The most valuable mineral output of the economy was crude oil, followed by the gem minerals, tin, tungsten, and lead.

Table 1.—Burma: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978^{p}	1979^{e}
METALS				
Antimony, mine output, metal content	468	500	620	635
Copper:				
Mine output, metal content	92	45	56	100
Matte, gross weight	205	99	125	^{2}148
Iron and steel: Crude steel^{e}	40,000	40,000	40,000	--
Lead:				
Mine output, metal content^{e}	^{r}7,100	8,900	7,200	11,000
Metal:				
Refined, including secondary	3,331	4,833	4,975	5,100
Antimonial lead (18%-20% Sb)	187	120	127	130
Nickel:				
Mine output, metal content^{e}	24	17	18	18
Speiss, gross weight	94	69	70	^{2}67
Silver, mine output thousand troy ounces	211	355	377	272
Tin, mine output, metal content:				
Of tin concentrate	264	114	346	560
Of tin-tungsten concentrate	243	248	411	600
Total	507	362	757	1,160
Tungsten, mine output, metal content:				
Of tungsten concentrate	109	108	189	290
Of tin-tungsten concentrate	167	170	282	410
Total	^{r}276	278	471	700
Zinc, mine output, metal content	2,211	1,834	2,645	3,000

See footnotes at end of table.

Table 1.—Burma: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
NONMETALS				
Barite[3]	15,681	16,096	35,320	36,000
Cement, hydraulic thousand tons	233	269	254	320
Clays:[3]				
Ball clay	5,762	4,674	4,573	[2]4,294
Bentonite	955	975	1,377	1,500
Fire clay[4]	2,792	4,627	4,878	[2]4,717
Industrial white clay	4,393	3,449	2,000	[2]6,876
Feldspar[3]	1,709	1,422	2,000	2,000
Graphite[3]	161	96	280	250
Gypsum[3]	45,296	33,511	35,431	35,000
Pigments, mineral, natural: Iron oxide	616	230	461	400
Precious and semiprecious stones: Jadeite[3] kilograms	31,387	6,532	12,454	7,707
Salt thousand tons	[r]126	230	304	300
Stone:[3]				
Dolomite	[r]1,016	431	1,616	[2]1,882
Limestone, crushed and broken thousand tons	645	1,159	1,437	[2]1,259
Quartz	116	73	--	[2]122
Talc and related materials: Soapstone[3]	238	201	391	360
MINERAL FUELS AND RELATED MATERIALS				
Coal	20,931	23,926	33,113	[2]36,064
Gas, natural:				
Gross million cubic feet	13,300	16,000	17,000	18,000
Marketed[3] do	8,481	8,784	12,638	13,500
Petroleum:				
Crude thousand 42-gallon barrels	8,183	9,178	9,995	10,700
Refinery products:[5]				
Gasoline do	1,646	1,864	1,864	2,000
Jet fuel do	216	248	[e]280	300
Kerosine do	1,117	909	744	540
Distillate fuel oil do	2,045	2,351	2,500	2,600
Residual fuel oil do	1,012	1,279	1,532	1,600
Lubricants do	140	133	140	140
Other do	177	179	[e]223	220
Total do	[r]6,353	6,963	7,283	7,400

[e]Estimate. [p]Preliminary. [r]Revised.

[1] In addition to the commodities listed, pottery clay, common sand, glass sand, other varieties of crude construction stone, and other varieties of gem stones are also produced, but available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

[3] Data are for fiscal years beginning Apr. 1 of that stated.

[4] Includes fire clay powder.

[5] Data exclude products used as fuel in refineries.

TRADE

The mining industry usually ranked third after agriculture and forestry products in value of exports. While detailed trade data were not available, the relative importance of the mining sector was not believed to have changed in 1978 and 1979. Burma generally exports nearly all of its nonfuel mineral output, particularly in the metallic sector. Mineral fuels were consumed domestically.

There was a rise in exports of all minerals and ores, both in quality and value in comparison with 1976, the last calendar year for which individual figures were available. Overall, the estimated value of mineral exports during 1978 constituted 11% of Burma's total export earnings as against 7% in 1976.[8]

COMMODITY REVIEW

METALS

Copper.—Burma and Yugoslavia signed a $70 million loan agreement for the development of the Monywa copper project. The deposits are located just west of the Chindwin River, opposite the railhead town of Monywa. The main deposits are in the Kyesintaung and Sabetaung ranges. The Kyesintaung deposit contains 55 million tons grading about 0.5% Cu, and the Sabetaung deposit, 26 million tons grading just over 1.02% Cu.[9] Open pit mine workings will be scaled to produce 2.4 million tons per year of ore. The ore will be processed in a flotation plant with a capacity of 60,000 tons per year of concentrate containing 22% to 25% Cu. Related infrastructure will also be established. Design and technology will be supplied by RTB Bor, Yugoslavia's copper mining and smelting conglomerate, together with other Yugoslavian firms. The Yugoslavians will build the plant and assist the Burmese in the early stages, but the Burmese officials will be in full charge of management and operations. Much of the excavation hardware reportedly will be supplied by American manufacturers or their licensees. The concentrate will be exported. Construction on the concentrator was scheduled to begin in early 1980 and the entire contract was to be completed within 4 years. The agreement did not include the building of a copper smelter and refinery, which were still in the planning stage.

Currently the country's copper production ranges from 100 to 200 tons per year of copper matte, obtained as a byproduct from the Namtu lead smelter.

Iron and Steel.—In July 1979 the No. 3 Mining Corp. reportedly signed a turnkey contract with Italy's Danieli & C. Spa. for a 20,000-ton-per-year Kinglor Metor direct reduction plant, a 15-to 17-ton electric arc furnace, and for metal casting equipment. Provision for later expansion included a continuous billet casting machine. The total cost of the contract was valued at DM33 million. The plant will be located at Anisakan in Maymyo township.

Lead and Zinc.—Most of the lead and zinc concentrate production, valued at nearly $5 million, came from the famed Bawdwin mine in northern Shan State. Once one of the richest lead mines in the world, production had been hindered by declining ore grade and deteriorating mine and plant facilities. The decline in ore grade was a relative one as the run-of-mine ore averages over 10% combined metal content. Earlier high-grade ore veins were mined selectively at over 40% metal content. However, in 1978, the nearly 225,000-ton ore production was the highest since 1970 because grants and credits from the Federal Republic of Germany (FRG) enabled the No.1 Mining Corp. to acquire new equipment and rehabilitate the existing plant. Modernization of the workshop with a DM5 million grant was completed, and the improved facility was operating at yearend 1978. Updating the workshop was critical because spare parts for the 65-year-old equipment and facilities were difficult to obtain and transportation to the mine was subject to attack by insurgents and bandits. Virtually all spare parts and replacements will now be fabricated in the well-equipped workshop.

The DM5 million credit obligated in 1976 for development of an open pit mine at Bawdwin had not been utilized by mid-1979. It was still planned to begin the open pit operation as soon as feasible. Conversion of Bawdwin mine to an open pit operation would generate a large increase in ore production.

The mine operates its own narrow-gage railroad, which runs from Namtu 22 kilometers west to Bawdwin and 51 kilometers east to Namyao. In 1978, the No. 1 Mining Corp. ordered 10 diesel locomotives to replace the worn out and cannibalized steam equipment which had been used for decades. The current needs were for four locomotives, but the remainder will be needed as ore production is increased over the next 2 years. This approval to procure capital equipment in advance of immediate needs was unprecedented among Burmese Government agencies.

Plans for the zinc smelter slated for Pyinmana, to be beyond the reach of insurgents, have been dropped. FRG-financed feasibility studies, to utilize the huge quantity of lead and zinc tailings and slag accumulated over the past 65 years at Bawdwin, were planned. One study will consider the production of zinc oxide clinker from the zinc-rich smelter slags by the Waelz process. The second will examine the possible recovery of silver by a leaching process from the lead-zinc flotation plant tailings. The studies were scheduled for completion by yearend 1980.

Tin and Tungsten.—These were the most valuable metallic minerals produced in Burma with exports totaling over $12 million in 1978. The major mines were at Heinda, Kanbauk, Myinmatti, Natsan, and Yadanabon. Numerous small-scale private mining operations sell their output to the Government and contributed more than one-half of the total concentrate. Unstable conditions, however, permit considerable illicit tin and tungsten mining with the output being smuggled out of Burma to Thailand, Malaysia, or Singapore.

Production of tin and tungsten concentrates increased substantially for the second straight year, partly because of the production from the modernized Heinda tin mine and concentration plant. Heinda was the country's largest tin producer, turning out approximately 500 tons in 1978. The new mill ran into problems with ore characteristics that were not anticipated in the design of the plant. As a result, the FRG was to provide additional funding for modifications which will permit recovery of extremely fine-grained cassiterite not encountered in previous run-of-mine ore. The plant was designed to produce 1,000 tons of 72% tin concentrate per year.

The Government's FY 1979-80 plan called for another increase in tin and tungsten production. Preliminary production data for the first three quarters of 1979 indicate output of the concentrates and mixed tin-tungsten concentrates did indeed increase substantially over the same period in 1978.

Exploration was still underway at the Hermingyi underground tin mine. A study was to be made to determine if further development work was worthwhile.

The rich tin-tungsten deposits along the Tennassarim coast in south Burma were still not being efficiently exploited during 1978 and 1979. However, work was underway and orders were placed for all of the major equipment needs under the tin-tungsten expansion project funded by a $16 million International Development Association credit. This project was designed to exploit the alluvial deposits in the shallow offshore areas. The new dredge and processing equipment will not be available until late 1980.

NONMETALS

Overall, the industrial mineral sector had a particularly good year in 1978. Limestone production jumped in response to increased demand from the new Kyangin cement plant and various construction projects. The capacity of the new cement plant was not announced, and it was unclear how much of the 340,000 tons produced in 1978 came from the new plant or how many other plants contributed to the total. The Government plan proposed cement output at 400,000 tons for FY 1979-80. Barite output more than doubled in 1978, reflecting an increase in domestic and foreign oil well drilling. The plan target called for another substantial increase in barite production to 47,000 tons in FY 1979-80. Graphite, industrial clay, and dolomite each more than doubled the 1977 tonnages in 1978, and all other reported industrial minerals showed increases over those of the previous year. Brick and tile production also reflected an increase in construction activity during the year. Production was planned at over 150 million units for FY 1979-80, probably equating to around 350,000 to 400,000 tons of finished material.

Burma's Government planned to meet the fertilizer requirements of the agricultural sector in the next decade by adding a 91,000-ton-per-year N urea complex to the two 31,000-ton-per-year N urea plants already in operation, one in Pagan, the other in Sale. Like the existing units, the new plant will use natural gas as feedstock and fuel and will be located somewhere along the Irrawaddy River. The original choice of Kyungchuang was rejected because the water there was too shallow for barge transport of the product.[10]

In January 1978, the FRG agreed to provide a DM90 million low-interest loan as financial assistance to Burma for the construction of the new plant. Construction was reportedly due to begin about the end of 1979.

MINERAL FUELS

Coal.—Burma has few known deposits of coal and what was mined was poor quality. The main producer in 1978 and 1979 was the Kalewa coal mine where output increased for the second straight year and about doubled since 1974. The 33,000-ton overall output in 1978 was of little importance to the economy, and there were no known plans for large-scale expansion of production. The Government's target for FY 1979-80 coal production was set at about 38,000 tons. The coal, blended with high-quality imports, was consumed mainly in steam locomotives and small electric powerplants.

Petroleum and Natural Gas.—Burmese Government statistics indicated that crude oil production continued to climb in both 1978 and 1979. In July 1979 a Japanese firm signed a contract with Burma's Government owned oil company to purchase several thousand barrels per day of crude oil. The amount was to be the difference between daily production and the current capacity of Burma's refineries. Burma's ability to store oil in excess of its needs either at the oilfields or at the refineries was very limited. The first shipment arrived in Japan at the end of September 1979. The foreign exchange earned from the sale will strengthen Burma's balance of payments considerably.

Because of limited refinery capacity, motor fuels and kerosine were in short supply during 1978, particularly in northern Burma and in the outlying States. There were reports of industrial stoppages due to lack of fuel.[11] The Government's firm policy of not importing petroleum was exacerbating the shortages at a time of rising demand by industry and the populace.

In order to supply the increasing needs for petroleum producers, a new 25,000-barrel-per-day refinery was being built at Mann oilfield, with financing and construction being carried out with Japanese assistance. Completion was scheduled for 1982. In addition, the 20,000-barrel-per-day Syriam refinery was slated for modernization, also with Japanese aid.

There was no offshore exploration activity in Burma in 1978 or 1979; however, in October 1978 the Government issued an invitation to foreign oil companies to submit bids on all offshore blocks, including those previously withheld for Government use. Reportedly only three firms made formal conditional responses. Lack of interest on the international oil companies' part was attributed to comparatively unattractive terms, very high data fees, and costly Government operation regulations.

Onshore exploration was conducted solely by the Government's Myanma Oil Corp. (MOC). It was not anticipated that foreign firms would be invited to participate. Exploration activity was considerably lower in 1978 than in previous years, mostly because of cuts in the MOC operating budget. There were no confirmed reports of significant finds in 1978 or 1979.

MOC took delivery of several new drilling rigs and ordered several more during 1978. The new equipment should enhance the future onshore exploration and development program.

Work was completed in April 1979 on the major pipeline connecting the Mann oilfield with the Syriam refinery near Rangoon. The final 280-kilometer section of 25.4-centimeter pipe was laid between Prome and the refinery. Completion of the line eliminated the slow and costly river barge traffic formerly used to deliver most of the crude oil to the refinery.

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[1] Physical scientist, Branch of Foreign Data.

[2] Ministry of Planning and Finance. Reports to the Pyithu Hluttaw on the Financial, Economic, and Social Conditions of the Socialist Republic of the Union of Burma for 1977-78. 1978, pp. 2 , 10-11.

———. Report to the Pyithu Hluttaw on the Financial, Economic, and Social Conditions of the Socialist Republic of the Union of Burma for 1979-80. 1979, pp. 1-2, 7, 22-23.

[3] U.S. Embassy, Rangoon, Burma. Industrial Outlook Report - Minerals. Department of State Airgram A-32, June 2, 1979, p. 2.

[4] The Burmese fiscal year runs from April 1 to March 31. Values have been converted from Burmese kyats (K) to U.S. dollars at the average rate of FY 1977-78 K6.787 = US$1.00; FY 1978-79 K7.184 = US$1.00.

[5] U.S. Embassy, Rangoon, Burma. Economic Trends Report for Burma. Department of State Airgram A-007, June 14, 1979, pp. 2-3.

[6] P. 19 of first work cited in footnote 2.

[7] P. 3 of source cited in footnote 3.

[8] P. 3 of source cited in footnote 3.

[9] World Mining. V. 31, No. 13, December 1978, p. 80.

[10] The British Sulphur Corp. Ltd., London, England. Nitrogen. No. 116, November-December 1978, p. 27.

[11] U.S. Embassy, Rangoon, Burma. Petroleum Outlook Report - Burma. Department of State Airgram A-14, Mar. 16, 1978, pp. 2-3.

The Mineral Industry of Canada[1]

By Charlie Wyche[2]

Although the relatively depressed state of the world's industrial economies resulted in reduced demand for Canadian minerals in 1978, Canada's mining and mineral processing industries both showed impressive gains in 1979. The value of mineral production rose strongly in all but one of Canada's provinces and territories. Although the volume of output fell for some major metals in 1979, higher prices improved the outlook for producers and stimulated many investment projects. Mines that had long been abandoned were reopened, existing mines were expanded, mining employment increased, and new exploration projects were started. The most significant market improvements were for precious metals, copper, aluminum, rolled steel, molybdenum, and potash.

The fuel sector also made impressive gains and attracted new capital for exploration and development. Offshore oil and gas discoveries made in 1979 were encouraging and helped to make Canada's announced goal of self-sufficiency in the 1990's much more attainable. Prices for coal and uranium remained strong, and both industries grew and prepared for future expansion during 1979.

PRODUCTION

According to the Canadian Department of Energy, Mines and Resources, overall mineral production and production value rose only slightly in 1978, compared with the 1977 levels, but were up significantly in 1979. The total value of domestic mine output in 1978 increased only slightly, to $17.2 billion,[3] [4] but the value in 1979 increased by more than 29% and reached $22.2 billion. Mineral production value accounted for 8.5% of the 1978 gross national product (GNP), which was estimated at $202.1 billion, and 10% of the 1979 GNP, which was estimated at $216.7 billion. The value of metals produced increased 51% in 1979, to $6.8 billion, compared with $4.5 billion in 1978. The production value of mineral fuels increased 25% during 1979 and reached a record high of $12.4 billion. The value of nonfuels mineral production increased 33% above the 1978 level, to $10.0 billion. Production values of the leading mineral commodities in 1979 were as follows: Crude petroleum, $6.5 billion; natural gas, $4.0 billion; iron ore, $1.6 billion; copper, $1.3 billion; natural gas products, $1.2 billion; and zinc $0.9 billion.

Although a few of the provinces and territories actually increased production of some commodities in 1979, the sharp increases in value were due mainly to higher prices. Real growth was small or nonexistent, and for copper, gold, silver, lead, molybdenum, platinum metals, and uranium, output in physical terms declined in most regions. The most significant changes of the year occurred in the gold market, where the price increased more than 200%. The Province of Alberta, with its large oil and gas output, accounted for approximately 50% of Canada's total mineral production value in both 1978 and 1979. The mineral production values of the provinces and territories in 1978 and 1979 were as follows:

Province or territory	Value, billion dollars	
	1978	1979
Alberta	8.6	11.0
Ontario	2.3	2.8
British Columbia	1.6	2.3
Quebec	1.6	1.9
Saskatchewan	1.3	1.5
Newfoundland and Labrador	.54	.94
Manitoba	.36	.50
New Brunswick	.27	.45
Northwest Territories	.27	.35
Nova Scotia	.18	.17
Yukon Territory	.20	.26
Prince Edward Island	(1)	(1)
Total	17.22	22.17

[1] Less than 1/2 unit.

In 1979, Canada was the world's largest producer of asbestos, zinc, silver, and nickel; the second largest producer of potash, gypsum, molybdenum, and sulfur; and a leading producer of uranium, titanium, aluminum, cobalt, gold, lead, copper, iron, and platinum. Mineral deposits are located in all regions of Canada.

In January 1978, there were 345 nonfuel mining operations in the country. In metal mining, there were 109 underground mines, 43 open pits, 8 combination underground and open pit operations, 1 surface tailing operation, and 59 placer gold operations. In nonmetal mining, including construction materials, there were 18 underground mines, 102 open pits, and 7 solution-mining operations.

Table 1.—Canada: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Alumina, gross weight thousand tons	490	1,061	1,054	900
Metal, refined do.	633	973	1,048	[1]848
Antimony[e] [2]	[r]2,300	[r]3,175	2,994	3,000
Bismuth[3]	130	165	158	180
Cadmium[4]	1,314	1,185	964	1,480
Calcium kilograms	513,964	490,856	574,674	[1]477,000
Cobalt:				
Mine output, metal content[5]	1,356	1,485	1,234	[1]1,581
Metal[6]	298	459	519	545
Columbium and tantalum:				
Columbium concentrate (pyrochlore):				
Gross weight[e]	2,497	4,182	4,122	3,881
Cb_2O_5 content	[r]1,048	1,754	1,729	[1]1,682
Tantalum concentrate:				
Gross weight[e]	235	270	283	291
Cb_2O_5 content	7	8	8	8
Ta_2O_5 content	[r]105	120	126	[1]129
Copper:				
Mine output, recoverable metal content[7]	730,930	759,423	659,380	[1]643,754
Metal, primary and secondary:				
Blister and anode	488,594	500,274	425,300	[1]389,000
Refined	510,469	508,767	446,277	[1]397,283
Gold thousand troy ounces	1,692	1,734	1,735	[1]1,581
Iron and steel:				
Iron ore, gross weight thousand tons	[r]56,933	55,397	43,601	[1]61,273
Metal:				
Pig iron do.	[r]9,800	9,661	10,340	[1]10,906
Ferroalloys do.	225	193	200	152
Crude steel do.	[r]13,290	13,631	14,898	[1]16,078
Semimanufactures[8] do.	9,821	10,461	11,894	12,000
Lead:				
Mine output, metal content	256,324	280,955	365,782	[1]315,751
Metal, refined:				
Primary	175,720	187,457	194,054	187,100
Secondary	55,300	53,100	60,000	55,000
Magnesium metal, primary	6,092	7,633	8,309	[1]9,172
Molybdenum	14,619	16,568	14,068	10,000
Nickel:				
Mine output, metal content[9]	240,825	232,512	128,310	[1]131,578
Metal, smelter	176,400	168,700	107,400	[1]85,294
Platinum-group metals troy ounces	[r]416,821	465,371	346,213	[1]185,000
Selenium, refined[10] kilograms	[r]226,419	410,552	392,777	[1]511,704
Silver thousand troy ounces	41,199	42,236	40,733	[1]38,068
Tellurium, refined[10] kilograms	[r]53,141	37,021	45,299	[1]47,208
Tin, mine output, metal content	274	328	360	[1]232
Titanium:				
Ilmenite, gross weight thousand tons	2,115	1,442	1,810	1,219
Sorel slag (70%-72% TiO_2)	814,040	692,341	850,032	[1]477,040
Tungsten, mine output, WO_3 content	[r]1,720	1,812	2,286	[1]2,597

See footnotes at end of table.

Table 1.—Canada: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity		1976	1977	1978[p]	1979[e]
METALS —Continued					
Uranium oxide (U_3O_8)		[r]6,635	6,824	8,211	[1]6,956
Zinc:					
Mine output, metal content	thousand tons	[r]982	1,070	1,082	1,214
Metal, refined, primary		472,316	494,938	495,420	[1]580,000
NONMETALS					
Asbestos	thousand tons	1,536	1,517	1,422	[1]1,501
Barite		100,256	116,950	87,996	67,131
Cement, hydraulic[11]	thousand tons	9,624	9,640	10,558	[1]11,835
Clays and clay products[12]	value, thousands	$97,500	$108,360	$109,635	[1]$125,357
Diatomite[e]		500	500	500	500
Fluorspar (70% CaF_2)		64,000	59,500	--	--
Gypsum and anhydrite	thousand tons	6,002	7,234	8,074	[1]8,105
Lime	do	1,850	1,900	2,034	[1]2,092
Magnesite, dolomite, brucite	value, thousands	$4,007	$6,220	$5,990	[1]$8,990
Nepheline syenite		540,121	574,558	599,121	[1]617,000
Nitrogen, N content of ammonia		1,258,100	1,763,600	1,926,200	1,981,300
Pigments, mineral: Iron oxides, natural		--	--	--	2,700
Potash, K_2O equivalent	thousand tons	[r]4,996	6,089	6,124	6,600
Pyrite and pyrrhotite, gross weight		30,754	24,000	10,145	31,000
Salt	thousand tons	5,994	6,039	6,451	[1]6,672
Sand and gravel	do	249,159	262,905	272,092	[1]275,127
Silica	do	2,520	2,317	2,165	[1]2,246
Sodium compounds, n.e.s.:					
Sodium carbonate[e]	do	450	450	450	450
Sodium sulfate	do	460,193	394,795	376,563	[1]452,000
Stone[13]	do	87,876	120,163	122,144	[1]114,989
Strontium minerals: Celestite[e]		12,000	--	--	--
Sulfur:					
Elemental byproduct:					
Of smelter gases	thousand tons	705	766	670	[1]605
Of sour natural gas	do	6,241	6,475	6,248	5,935
Of refineries	do	200	160	200	200
Of tar sands	do	100	100	118	213
S content of pyrite and pyrrhotite[e]		15,377	[r]12,000	4,500	10,000
Talc, soapstone, pyrophyllite		68,834	72,400	61,661	[1]88,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e]		134,000	134,000	130,000	135,000
Coal:					
Bituminous and subbituminous	thousand tons	[r]20,812	23,201	25,419	[1]28,006
Lignite	do	[r]4,676	5,479	5,058	[1]5,013
Coke, high-temperature	do	[r]5,289	4,906	4,968	[1]5,775
Gas, natural:					
Gross	million cubic feet	3,515,844	3,588,500	3,569,046	[1]3,788,369
Marketed	do	3,096,510	3,160,525	3,128,056	[1]3,270,550
Natural gas liquids:					
Gross:					
Butane	thousand 42-gallon barrels	[r]22,562	22,976	21,133	[1]22,845
Propane	do	[r]34,078	34,695	32,792	[1]35,904
Pentanes plus	do	[r]47,953	47,468	42,423	[1]42,065
Condensate	do	[r]1,032	1,188	1,174	[1]1,255
Total	do	[r]105,625	106,277	97,522	[1]102,069
Returned to formation, all types	do	44	400	397	400
Peat moss		894,188	886,409	435,451	[1]409,000
Petroleum:					
Crude	thousand 42-gallon barrels	488,680	482,021	478,435	[1]544,988
Refinery products:					
Gasoline:					
Aviation	do	1,477	1,481	1,460	[1]1,649
Other	do	222,660	225,593	230,616	[1]248,729
Jet fuel	do	25,146	25,597	28,100	[1]30,350
Kerosine	do	27,047	26,064	23,557	[1]11,652
Distillate fuel oil	do	159,302	169,728	166,974	[1]197,009
Residual fuel oil	do	102,385	112,791	108,665	[1]113,888
Lubricants	do	4,140	4,287	4,551	[1]5,857
Other:					
Liquefied petroleum gas	do	10,514	11,360	13,070	[1]6,822
Petrochemical feedstocks	do	13,097	23,497	29,683	[1]32,183
Asphalt	do	17,396	18,422	18,628	[1]21,837
Petroleum coke	do	1,358	1,269	1,258	[1]1,029
Unspecified	do	8,757	7,217	3,711	[1]5,953

See footnotes at end of table.

Table 1.—Canada: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity		1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Refinery fuel and losses	do	31,283	31,697	33,742	[1]34,883
Total	do	624,562	659,003	664,015	[1]710,841

[e] Estimate. [p] Preliminary. [r] Revised.

[1] Reported figure.

[2] Sb content of antimonial lead alloys, flue dust, and dore slag, estimated on the basis of reported gross production.

[3] Refined metal and bullion from domestic ores plus recoverable Bi content of exported concentrates.

[4] Refined metal from domestic ores plus recoverable Cd content of exported ores and concentrates.

[5] Actual output not reported. Data represent Co content of all products derived from ores of Canadian origin, including nickel oxide sinter shipped to the United Kingdom and nickel-copper-cobalt matte shipped to Norway for further processing.

[6] Actual output not reported. Data represent the output within Canada of metallic cobalt from ores of both Canadian and non-Canadian origin.

[7] Blister copper from domestic ores plus recoverable Cu content of exported matte and concentrates.

[8] Includes shipments of ingots from primary plants for rolling elsewhere.

[9] Refined nickel from domestic ores plus Ni content of oxide produced and recoverable Ni content of exported matte.

[10] From all sources, including imports and secondary sources.

[11] Cement shipped and/or used by producers.

[12] Includes bentonite products from common clay, stoneware clay, fire clay, and other clays.

[13] Crushed, building, ornamental, paving, and similar stone.

TRADE

In 1978, Canada's exports of crude and fabricated mineral products totaled $12.3 billion, which was 10% above the value of these exports in 1977. These mineral exports accounted for 28% of the country's total 1978 exports of $44.6 billion. Total exports for 1979 were $16.8 billion, or 37% more than in 1978. Export volumes were down for many commodities, but values were up. Of the leading export commodities, based on the first 9 months of 1979, only primary aluminum, refined copper and nickel (in oxide and refined metal) showed decreases in value from the previous year. For these commodities, volumes were down due to strikes in each industry, and the increases in value were not enough to offset the sharp drops in production. Exports of lead in ores and concentrates showed a 33% increase in volume in 1979 and a 187% increase in value. About 70% of these exports went to U.S. markets and 13% went to members of the European Economic Community (EEC), principally the United Kingdom.

Imports of crude and fabricated mineral products totaled $5.7 billion, accounting for 14% of total imports, which were valued at $42 billion in 1979. Crude petroleum imports totaled $3.8 billion and accounted for 9% of all mineral imports. The principal sources of oil imports were Venezuela and Saudi Arabia. Imports of coal, valued at $734 million, came primarily from the United States. Other major mineral imports were bauxite, alumina, and aluminum scrap ($223 million combined) and iron ore and iron and steel scrap ($274 million combined).

Table 2.—Canada: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Alumina (excluding abrasive grades), metal content	24,211	32,698	United States 26,719.
Metal:			
Scrap	50,833	57,773	United States 43,005; Japan 11,892.
Unwrought	655,451	862,801	United States 489,886; Japan 168,818.
Semimanufactures[1]	44,382	40,407	United States 30,296.
Cadmium	870	1,259	United States 724; United Kingdom 378; Netherlands 125.

See footnotes at end of table.

Table 2.—Canada: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Calcium	269	280	United States 199; Republic of South Africa 35; Mexico 33.
Cobalt:			
Oxides and salts, gross weight	605	748	All to United States.
Metal	687	826	United States 740.
Columbium concentrate[2]	757	553	All to United States.
Copper:			
Ore and matte, metal content	279,582	282,158	Japan 213,760.
Slag, skimmings, and sludge, metal content	243	65	United States 53; United Kingdom 12.
Metal:			
Scrap:			
Unalloyed	16,808	16,905	United States 8,965; Republic of Korea 2,691.
Copper alloys	20,348	24,311	Mainly to United States.
Unwrought, unalloyed	294,534	247,749	United Kingdom 69,678; United States 64,195.
Semimanufactures:			
Unalloyed	27,084	29,611	United States 17,239.
Copper alloys	16,908	22,691	Mainly to United States.
Gold:			
Ore and concentrate, metal content thousand troy ounces	164	261	Japan 125; U.S.S.R. 60; United Kingdom 24.
Metal:			
Unalloyed do	1,389	1,526	United States 1,367.
Alloyed do	182	104	United States 52; Brazil 34; Trinidad and Tobago 13.
Iron and steel:			
Iron ore thousand tons	45,060	31,929	United States 18,878; Netherlands 3,587.
Metal:			
Scrap do	697	874	United States 622; Italy 151.
Pig iron and related materials do	557	602	United States 284; Netherlands 124; Japan 109.
Ferroalloys:			
Ferromanganese	23,150	20,193	Mainly to United States.
Ferrosilicon	45,512	60,197	United States 48,346.
Other	2,034	13,028	United States 11,610.
Steel ingots and other primary forms	239,964	280,963	United States 103,804; Republic of Korea 75,053; Venezuela 44,946.
Semimanufactures:			
Bars, rods, angles, shapes, sections	499,813	792,291	Mainly to United States.
Universals, plates, sheets, strip	901,850	1,031,020	United States 861,588.
Rails and accessories	137,620	195,565	United States 111,146; Mexico 28,841; Tanzania 23,124.
Wire	64,641	85,164	Mainly to United States.
Tubes, pipes, fittings	267,544	365,365	United States 324,568.
Castings and forgings, rough	211,827	191,508	United States 189,076.
Lead:			
Ore and concentrate, metal content	137,820	142,682	Japan 89,710; United States 22,207; Federal Republic of Germany 14,522.
Metal:			
Scrap including alloy scrap	15,963	15,368	United States 4,761; Sweden 3,534; Japan 3,003.
Unwrought, unalloyed	130,823	131,950	United States 65,411; United Kingdom 38,106.
Semimanufactures	7,818	8,758	Mainly to United States.
Magnesium metal	4,375	4,815	Federal Republic of Germany 1,291; United Kingdom 1,193; Japan 1,099; United States 532.
Mercury[3] 76-pound flasks	1,708	896	All to United States.
Molybdenum ore and concentrate, metal content[3]	15,310	13,421	Japan 4,262; Belgium-Luxembourg 4,214; United Kingdom 1,654; United States 1,644.
Nickel:			
Ore, matte, and speiss, metal content	80,546	39,077	Norway 22,090; United Kingdom 16,986.
Oxide, metal content	35,005	27,792	United States 21,320.
Metal:			
Scrap	2,208	2,308	United States 1,969.
Unwrought	79,039	107,252	United States 75,832; United Kingdom 18,785.
Semimanufactures	14,672	14,991	United States 12,104.
Platinum-group metals:			
Concentrates, residues, and mattes, metal content troy ounces	398,374	339,419	All to United Kingdom.
Metals:			
Scrap do	31,973	42,580	Mainly to United States.
Other do	69,406	34,727	United States 23,883; United Kingdom 8,780.

See footnotes at end of table.

Table 2.—Canada: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Selenium metal and salts, metal content kilograms	197,494	242,218	United States 108,000; United Kingdom 91,000.
Silver:			
Ore and concentrate, metal content thousand troy ounces	14,920	15,426	United States 9,005; Japan 3,933.
Metal, refined do.	36,808	34,628	Mainly to United States.
Tin ore and concentrate, metal content	876	943	Mexico 500; United States 301; United Kingdom 124.
Titanium: Ilmenite and ilmenite sand[3] [4]	75,072	46,846	All to United States.
Uranium and thorium concentrates value, thousands	$80,228	$236,302	United States $186,973; United Kingdom $44,608.
Zinc:			
Ore and concentrate, metal content	598,450	689,334	Belgium-Luxembourg 194,635; Japan 149,422; United States 133,844; Federal Republic of Germany 78,425.
Metal:			
Scrap, dross, ash, blue powder	22,659	23,380	United States 17,487; United Kingdom 2,799.
Unwrought	295,375	439,340	United States 259,475; United Kingdom 52,954.
Semimanufactures	2,025	1,329	Mainly to United States.
Other:			
Ores and concentrates, gross weight	379,569	160,619	United States 80,391; Federal Republic of Germany 60,013.
Ash and residue containing nonferrous metals	12,048	12,988	United States 5,193; Taiwan 4,078.
Oxides, hydroxides, peroxides of metals	90,181	91,430	Mainly to United States.
Metals:			
Base metals including alloys, all forms, n.e.s	788	1,366	United States 1,081.
Precious metals, n.e.s.[5] troy ounces	4,095	390	United Kingdom 267; United States 100.
NONMETALS			
Abrasives:			
Natural	40	1,065	Mainly to United States.
Fused alumina, crude and grains	154,308	167,363	Do.
Silicon carbide, crude and grains	86,051	107,350	Do.
Grinding and polishing wheels and stones value, thousands	$794	$677	United States $558.
Asbestos:			
Crude	1	1	All to United States.
Milled fiber, all grades thousand tons	1,415	1,399	United States 540; Federal Republic of Germany 150.
Barite, crude	69,421	56,783	United States 43,082; Venezuela 13,701.
Cement, portland thousand tons	1,275	1,635	Mainly to United States.
Clays and clay products (including all refractory brick):			
Crude, including refractory do.	766	1,103	Do.
Products:			
Refractory (including nonclay brick)[6]	40,809	54,409	United States 33,697.
Nonrefractory value, thousands	$2,593	$5,009	Mainly to United States.
Diamond:			
Gem carats	41,843	36,805	Belgium-Luxembourg 14,518; Israel 8,524; United States 6,576.
Industrial (including dust) do.	250,075	180,801	United States 120,855; Australia 22,431.
Fertilizer materials:			
Natural and manufactured:			
Nitrogenous thousand tons	1,051	1,284	Mainly to United States.
Potassic do.	9,206	9,387	Do.
Other, including mixed do.	579	558	United States 434; Pakistan 111.
Ammonia do.	574	481	All to United States.
Gypsum, crude do.	4,994	5,179	Mainly to United States.
Lime	359,539	478,551	Do.
Nepheline syenite	443,763	420,961	Do.
Pigments, mineral, including processed iron oxides	15,067	26,853	Do.
Precious and semiprecious stones, except diamond value, thousands	$3,384	$4,581	United States $2,412.
Salt and brine thousand tons	1,163	1,609	Mainly to United States.
Sand and gravel do.	274	270	Do.
Sodium sulfate	117,123	129,119	All to United States.
Stone:			
Limestone, crude, crushed, and refuse thousand tons	1,502	1,711	Do.
Quartzite do.	56	68	Mainly to United States.
Rough building and crude stone, n.e.s do.	196	564	United States 506.
Sulfur:			
Crude and refined do.	4,291	4,965	United States 1,182; Republic of South Africa 460.
Sulfuric acid, including oleum do.	294	205	Mainly to United States.

See footnotes at end of table.

Table 2.—Canada: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Talc, steatite, soapstone, pyrophyllite[3]	310	116	All to United States.
Other, crude ... value, thousands	$84,184	$96,354	Federal Republic of Germany $23,921; United States $23,489.
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous ... thousand tons	12,069	13,658	Japan 10,865.
Coke from coal	200,678	217,779	United States 153,135; Federal Republic of Germany 64,600.
Fuel briquets of coal and coke	--	43	All to United States.
Gas, natural ... million cubic feet	983,805	882,583	Do.
Peat	303,414	NA	
Petroleum:			
Crude ... thousand 42-gallon barrels	120,894	97,984	Do.
Refinery products:			
Gasoline ... do	2,441	1,209	Mainly to United States.
Distillate fuel oil ... do	1,993	3,049	United States 1,309; Sweden 540; Netherlands 407.
Residual fuel oil ... do	8,050	16,831	All to United States.
Lubricants ... do	20	21	United States 12; Cuba 2; St. Pierre and Miquelon 1.
Other:			
Liquefied petroleum gas ... do	46,869	36,182	Mainly to United States.
Asphalt ... do	444	649	Do.
Petroleum coke and pitch coke ... do	866	742	United States 577; Japan 133.
Total ... do	60,683	58,683	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ... do	559	4,545	Mainly to United States.

NA Not available.

[1] May include relatively minor quantities of certain shapes not normally included among semimanufactures.

[2] Partial figures, including U.S. imports for consumption only.

[3] Includes some scrap.

[4] Largely, if not all, used in the production of heavy aggregate.

[5] Excludes scrap and sweepings valued at $25,891,000 in 1977 and $35,538,000 in 1978.

[6] Excludes quantity valued at $7,614,000 in 1977 and $8,327,000 in 1978.

Table 3.—Canada: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite ... thousand tons	2,764	2,438	Guinea 1,053; Guyana 814; Sierra Leone 330.
Alumina ... do	822	1,056	Australia 445; Jamaica 335; United States 164.
Metal including alloys:			
Scrap	16,126	27,161	Mainly from United States.
Unwrought	20,789	11,480	United States 9,192.
Semimanufactures (including cable)	40,571	42,860	United States 36,638.
Antimony oxides	626	906	United Kingdom 741; Belgium-Luxembourg 119.
Chromium:			
Ore and concentrate, metal content	41,247	33,846	Philippines 14,044; Finland 7,642; United States 6,116.
Oxide and hydroxide	1,336	1,637	United States 1,270; United Kingdom 264.
Copper:			
Ore and concentrate (including scrap), metal content	20,192	45,935	United States 31,074; Chile 9,423; Peru 4,860.

See footnotes at end of table.

Table 3.—Canada: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Copper —Continued			
Copper sulfate	2,411	886	U.S.S.R. 320; Republic of South Africa 270; United States 155.
Metal:			
Unalloyed:			
Unwrought	18,821	21,440	United States 11,508; Chile 6,870; Peru 2,900.
Semimanufactures	7,499	7,508	United States 4,435; Chile 1,268.
Alloys, unwrought and semimanufactures (including cable)[1]	19,025	20,499	United States 12,436; Federal Republic of Germany 2,257.
Gold:			
Ore and concentrate troy ounces	56,979	11,151	United States 5,593; Peru 3,258; Japan 1,168.
Metal including alloys thousand troy ounces	388	1,327	United States 1,068; Nicaragua 133.
Iron and steel:			
Iron ore thousand tons	2,505	4,686	United States 3,861.
Metal:			
Scrap do	584	952	Mainly from United States.
Pig iron and related materials	20,531	10,586	Do.
Ferroalloys:			
Ferrochrome	32,947	30,431	Republic of South Africa 13,499; United States 11,778; Brazil 4,300.
Ferromanganese (includes spiegeleisen)	29,404	26,811	Republic of South Africa 11,803; Norway 6,957; United States 5,864.
Silicomanganese	4,835	15,842	United States 6,309; Norway 5,778; Brazil 1,744.
Ferrosilicon	9,131	10,487	United States 8,669.
Ferrotungsten	103	73	France 46; United Kingdom 23.
Ferrovanadium	138	150	United States 118; Republic of South Africa 31.
Other	17,115	17,369	Greece 10,005; United States 2,809; Dominican Republic 2,253.
Steel, primary forms	61,388	54,552	United States 29,968; Brazil 16,536; United Kingdom 5,980.
Semimanufactures:			
Bars, rods, angles, shapes, sections:			
Wire rod	176,417	190,349	Czechoslovakia 52,642; France 52,504; Japan 50,186.
Other bars and rod	125,085	128,606	United States 79,059; United Kingdom 18,953.
Angles, shapes, sections	225,869	151,489	United States 59,951; Belgium-Luxembourg 27,894; Federal Republic of Germany 26,628.
Universals, plates, sheets, strip	552,349	698,269	United States 276,970; Japan 131,105; Federal Republic of Germany 97,579.
Rails and accessories	26,264	27,636	All from United States.
Wire	64,249	57,584	United Kingdom 18,438; United States 14,033; Japan 6,430; France 6,274.
Tubes, pipes, fittings	203,238	317,132	Japan 168,193; United States 104,898.
Castings and forgings	129,487	116,404	Mainly from United States.
Lead:			
Oxide	336	322	United States 144; Mexico 102; United Kingdom 43; Republic of South Africa 32.
Metal including alloys, unwrought and semimanufactures	3,326	3,984	Mainly from United States.
Magnesium metal including alloys	2,253	2,525	United States 2,160; United Kingdom 282.
Manganese:			
Ore and concentrate, metal content	57,644	136,445	Gabon 39,758; Brazil 38,302; Republic of South Africa 33,250.
Metal	6,850	7,939	Mainly from Republic of South Africa.
Mercury 76-pound flasks	711	1,398	Netherlands 706; United States 561.
Molybdenum: Molybdic oxide, gross weight	192	329	United States 249; United Kingdom 39; Belgium-Luxembourg 36.
Nichel:			
Ore and concentrate (including scrap), metal content	32,497	31,883	Australia 16,506; United Kingdom 9,967; United States 4,686.
Metal including alloys:			
Unwrought	2,405	1,442	United States 1,112; Norway 245.
Semimanufactures	5,449	7,586	United States 4,544; Dominican Republic 1,999.
Platinum-group metals and silver:			
Ores and concentrates, metal content thousand troy ounces	12,812	9,676	United States 4,557; Bolivin 1,698; Peru 1,684.
Metals:			
Platinum-group troy ounces	35,061	56,169	United States 48,853.
Silver thousand troy ounces	1,061	1,157	United States 968; United Kingdom 177.
Sodium metal	7,119	7,260	Mainly from United States.

See footnotes at end of table.

Table 3.—Canada: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Tin metal, unwrought and semimanufactures	5,651	5,128	United States 3,981.
Titanium:			
Titanium dioxide, pure and extended	4,973	7,093	United States 3,735; Federal Republic of Germany 1,456; United Kingdom 1,115.
Metal	371	640	United States 569.
Tungsten ore and concentrate, metal content	--	1	All from United States.
Zinc:			
Ore and concentrate (including scrap), metal content	6,047	6,144	United States 2,838; Japan 1,520; Peru 1,033.
Oxide and peroxide	4,036	2,066	United States 1,676; United Kingdom 273.
Metal:			
Blue powder	156	271	Mainly from United States.
Unwrought	3,329	2,405	Peru 1,100; United States 816.
Semimanufactures	4,301	1,317	United States 1,060.
Zirconium metal alloys	223	326	Mainly from United States.
Other:			
Ores and concentrates (including scrap), gross weight	126,959	117,692	United States 59,921; Australia 36,571.
Oxides, hydroxides, peroxides of metals	7,128	7,011	United States 5,976.
Metals:			
Base metals including alloys, all forms, n.e.s	2,482	2,253	United States 1,677.
Precious metals, n.e.s troy ounces	31,457	37,422	Mainly from United States.
NONMETALS			
Abrasives, natural:			
Crude	23,821	18,504	Do.
Grinding and polishing wheels and stones value, thousands	$9,116	$12,684	United States $8,802.
Asbestos	4,112	756	Republic of South Africa 508; United States 239.
Barite, crude	5,979	15,635	All from United States.
Boric oxide and acid	5,261	8,688	United States 6,997.
Cement	263,527	256,721	United States 222,124; Japan 32,991.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	358,724	295,707	United States 218,270; Greece 77,436.
Fire clay	45,603	34,875	Mainly from United States.
Fuller's earth	2,356	225	All from United States.
Kaolin (china clay)	153,775	181,886	United States 156,664; United Kingdom 25,219.
Other (including refractory clay)	144,758	172,385	Mainly from United States.
Products:			
Refractory (including nonclay brick) value, thousands	$42,106	$44,609	United States $38,753.
Nonrefractory do	$38,479	$33,265	Italy $12,159; Japan $4,769; Spain $4,385; Federal Republic of Germany $3,678; United States $3,525.
Cryolite, crude	1,212	1,431	Mainly from Denmark.
Diamond:			
Gem, not set or strung carats	208,971	165,170	Belgium-Luxembourg 71,823; Israel 41,110; United States 18,271.
Industrial do	829,589	1,023,583	United States 552,668; Ireland 338,398.
Dust and powder do	693,236	750,417	Mainly from United States.
Diatomite	27,180	25,370	All from United States.
Fertilizer materials:			
Natural and manufactured:			
Nitrogenous	111,986	139,151	United States 129,969.
Phosphatic:			
Phosphate rock	2,436,845	2,961,379	Mainly from United States.
Other	200,445	286,255	Do.
Potassic	105,633	75,430	Do.
Other, including mixed	131,727	96,373	Do.
Ammonia	24,498	54,918	Do.
Fluorspar	124,493	170,236	Mexico 109,236; Republic of South Africa 29,250.
Gypsum	24,042	70,995	Mexico 58,358; United States 12,436.
Iodine	161	174	Mainly from Japan.
Lime	24,480	31,129	Mainly from United States.
Magnesium:			
Dolomite, calcined	2,162	2,906	All from United States.
Dead-burned or sintered	50,410	61,997	United States 47,330; Federal Republic of Germany 7,389.
Other	3,618	3,304	Mainly from United States.
Mica, crude	6,309	3,491	Do.
Pigments, mineral, including processed iron oxides	10,067	12,892	United States 8,200; Federal Republic of Germany 2,999.

See footnotes at end of table.

Table 3.—Canada: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Precious and semiprecious stones, except diamond value, thousands	$13,597	$15,692	United States $4,870.
Salt and brine	1,126,225	1,330,474	United States 980,659; Mexico 327,766.
Sodium and potassium compounds, n.e.s.:			
Sodium carbonate (including sal soda)	174,553	176,232	Mainly from United States.
Caustic soda	236,806	348,650	United States 256,583; Federal Republic of Germany 63,871.
Sodium sulfate (Glauber's salt)	34,639	25,178	United Kingdom 14,561; United States 10,616.
Caustic potash and sodic and potassic peroxides	4,932	5,263	Mainly from United States.
Stone, sand and gravel:			
Stone:			
Dimension:			
Crude and partly worked	43,577	34,022	United States 17,961; Republic of South Africa 10,358.
Worked value, thousands	$4,792	$6,619	United States $4,465; Federal Republic of Germany $1,286.
Limestone thousand tons	2,923	2,874	Mainly from United States.
Pumice and lava	57,284	11,463	Do.
Quartz, silex and crystallized	1,219	1,954	Do.
Other, including crushed and broken	75,695	66,239	Do.
Sand and gravel:			
Silica sand thousand tons	1,101	1,242	Do.
Other do.	1,646	1,810	Do.
Sulfur:			
Elemental	14,065	8,130	Do.
Sulfuric acid, including oleum	6,634	107,765	United States 60,914; Sweden 21,598; Mexico 15,568.
Talc, steatite, soapstone, pyrophyllite	33,769	33,349	Mainly from United States.
Vermiculite, crude	53,951	50,633	United States 31,828; Republic of South Africa 18,805.
Other:			
Crude value, thousands	$5,224	$7,135	United States $6,389.
Oxides and hydroxides of magnesium, strontium, barium	16,054	28,904	Mainly from United States.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s value, thousands	$6,961	$8,458	United States $5,592; United Kingdom $2,510.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural do.	$40,833	$2,723	Venezuela $1,649; United States $959.
Carbon black	6,529	8,193	Mainly from United States.
Coal, all grades thousand tons	15,302	13,226	Do.
Coke from coal do.	373	553	United States 495.
Fuel briquets of coal and coke	21,618	9,697	All from United States.
Gas, natural million cubic feet	27	61	Do.
Hydrogen and other rare gases	49,093	56,102	Mainly from United States.
Petroleum:			
Crude thousand 42-gallon barrels	239,278	231,593	Venezuela 79,132; Saudi Arabia 50,421; Iran 41,190; United States 32,658.
Refinery products:			
Gasoline:			
Aviation do.	14	3	All from United States.
Motor do.	(²)	12	Netherlands Antilles 10; United States 2.
Kerosine do.	1	6	United States 4; Netherlands Antilles 1.
Jet fuel do.	199	336	Netherlands Antilles 219; Netherlands 107.
Distillate fuel oil do.	1,122	242	Mainly from Netherlands Antilles.
Residual fuel oil do.	7,138	10,272	Venezuela 5,668; United States 2,348.
Lubricants (including grease) do.	1,329	1,328	United States 966; Trinidad and Tobago 253.
Other:			
Liquefied petroleum gas do.	57	73	Mainly from United States.
Naphtha do.	54	46	All from United States.
Asphalt road oils do.	80	80	Do.
Petroleum and pitch coke do.	4,923	5,357	Mainly from United States.
Petroleum jelly and wax do.	76	96	Do.
Unspecified do.	1,603	1,676	Do.
Total do.	16,596	19,527	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	105,452	128,205	United States 64,748.

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[1] May include relatively minor quantities of certain shapes not normally included among semimanufactures.

[2] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Exploration activity in all the provinces and territories remained high in 1978 and 1979, and some 9,000 claims were staked. The principal metals searched for were gold, copper, lead, zinc, and silver. Increased exploration activity resulted from sharp increases in the prices of most metals during 1978 and 1979, in particular gold, silver, and platinum. The price of gold moved from a low of $166 per troy ounce during 1978 to a high of $517 per troy ounce in 1979. Although silver production declined 6% in 1979, its value increased by 80%. Platinum output was down 47%, but recorded only a 14% decline in value.

The copper market was also very volatile in 1978 and 1979. As a result of an 8-month strike that started in September 1978 at Inco Ltd.'s Sudbury operation and a strike at Noranda Mines Ltd. at Gaspè, inventories were drawn down, and the volume of production was reduced in the first half of 1979. These factors, combined with improved consumer demand, caused the price of copper to escalate. The price was 86 cents per pound in January 1979, but by March it had risen to a high of $1.22 per pound. During the summer, the price stabilized and averaged approximately $1.00 per pound, but in September it reached a record high of $1.30 per pound. As the earnings of the copper producers improved substantially, several new mine openings and major programs to expand capacity were announced. Included in these announcements were the reopening of Highmont Mining Corp. and Valley Copper Mines Ltd. and an expansion program by Lornex Mining Corp. Ltd., which was already one of the largest copper producing mines in Canada. The aluminum industry also experienced a record price increase brought on by tight market supplies, due partly to labor problems at Aluminum Co. of Canada's smelter operations in Quebec. The nickel industry, plagued by layoffs and cutbacks in production in 1978, was more stable in 1979. Production was down in 1979, but prices reached record high levels. Lower production rates were also reported for lead, zinc, and molybdenum. The iron ore industry recorded a strong increase in output of about 40% over that of 1978. Many mines returned to full operation after the labor strikes of 1978, but the world industry continued to be plagued by problems of oversupply. However, the demand for steel remained strong, and several major producers made plans to double their capacities.

NONMETALS

In the asbestos industry, production, sales, and exports continued to increase in 1978 and 1979. The Quebec government continued with its exploration plans for Asbestos Corp. Ltd., by far the largest producer in Canada. In the potash industry, Potash Corp. of Saskatchewan instituted expansion plans based on forecasts of both steady and strong growth in world demand for fertilizer. Almost half of the world's known reserves of potash are in Saskatchewan. The value of potash production increased almost 38% in 1979, compared with that of 1978, and about 70% of the potash produced was exported to the United States. The demand for cement was strong, and new capacity was under development. Sulfur output increased some 18% over that of 1978, and Canada remained the world's largest exporter of sulfur. Gypsum production in Canada was up slightly over that of 1978, and lime producers operated at near capacity levels throughout 1978 and 1979.

MINERAL FUELS

The Canadian coal industry increased its output and prepared for future expansion during 1979. New coal mines and expanded production capabilities at existing mines were being developed to supply coal for this growing sector. Existing and potential coking coal producers were active in marketing and predevelopment work in an attempt to win contracts in traditional markets such as Japan and with new consumers in Asia, Latin America, and Europe.

In 1978 and 1979, many sectors of the Canadian petroleum industry surpassed the levels of activity achieved in 1977. Although established reserves of crude oil continued to decline, natural gas reserves increased substantially. The number of wells drilled in 1978 was 10% higher than the number drilled in 1977, and the number drilled in 1979 was 5% higher than it was in 1978. In 1978, 6,700 wells were drilled for a total of 7 million meters, and in 1979, 7,500 wells were drilled for a total of 8.6 million meters. Most of the drilling and exploitation activity during 1978 and 1979 occurred in Alberta. Expenditures for exploration and development increased by $2.4 billion to an alltime high of $10.5 billion in 1979.

Exports to the United States of crude oil, refined products, and liquid petroleum gas all increased during 1979. Although refinery capacity remained unchanged from 1978, many of the facilities were undergoing minor alterations to enable them to process heavier grade crude oils. Increased demand resulted in refineries operating at 77% of capacity, compared with 66% in 1978.

Uranium exploration and development activity remained high, particularly in Saskatchewan, where another potentially important new discovery was announced and one new production facility was under construction. According to the Department of Energy, Mines and Resources, some $90 million was spent on exploration in 1979, of which $50 million was spent in Saskatchewan. Extensive expansion programs continued in Ontario's Elliot Lake area, and new production projects were being planned in British Columbia and Newfoundland. According to the Department of Energy, Mines and Resources, some 300 exploration projects, many of which involved foreign participation, were recorded during 1979.

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[1] For more detailed information on the mineral industry of Canada, see the Canadian Minerals Yearbook for 1978 and 1979 and the Canadian Mineral Survey for 1978 and 1979, both of which were prepared by the Mineral Development Sector, Department of Energy, Mines and Resources, Ottawa. The U.S. Bureau of Mines has arranged to have these Canadian publications placed in libraries in each of the 50 States and Puerto Rico at the following locations: University of Alabama, Tuscaloosa; E. E. Rasmuson Library, University of Alaska, Fairbanks; University of Arizona, Tucson; University of Arkansas, Fayetteville; California State Library, Sacramento; A. Lakes Library, Colorado School of Mines, Golden; Wilbur Cross Library, University of Connecticut, Storrs; H.M. Morris Library, University of Delaware, Newark; Strozier Library, Florida State University, Tallahassee; P. Gilbert Memorial Library, Georgia Institute of Technology, Atlanta; University of Hawaii, Hilo; University of Idaho, Moscow; Morris Library, Southern Illinois University, Carbondale; Indiana University, Bloomington; Iowa State University of Science and Technology, Ames; Watson Library, University of Kansas, Lawrence; M.L. King Library, University of Kentucky, Lexington; University of Southwestern Louisiana, Lafayette; R.H. Folger Library, University of Maine, Orono; Eisenhower Library, Johns Hopkins University, Baltimore, Md.; Massachusetts Institute of Technology, Cambridge; Michigan Technical Library, Houghton; Wilson Library, University of Minnesota, Minneapolis; University of Southern Mississippi, Hattiesburg; Rolla Library, University of Missouri, Rolla; Montana College of Mineral Science and Technology, Butte; D.L. Love Library, Nebraska Geological Survey at University of Nebraska, Lincoln; University of Nevada, Reno; University of New Hampshire, Durham; J.C. Dana Library, Rutgers University, Newark, N.J.; New Mexico Institute of Mining and Technology, Socorro; Columbia University, New York, N.Y.; D.H. Hill Library, North Carolina State University, Raleigh; Frity Library, University of North Dakota, Grand Forks; Ohio State University, Columbia; University of Oklahoma, Norman; Multnomah County Library, Portland, Oreg; Pennsylvania State University, University Park; University of Rhode Island, Kingston; University of South Carolina Undergraduate Library, Columbia; South Dakota School of Mines and Technology, Rapid City; Tennessee State Library and Archives, Nashville; Main Library, University of Texas, Austin; Marriott Library, University of Utah, Salt Lake City; Bailey Library, University of Vermont, Burlington; Virginia Polytechnic Institute, Blackburg; University of Washington, Seattle; West Virginia University, Morgantown; Memorial Library, University of Wisconsin, Madison; University of Wyoming, Laramie; and University of Puerto Rico, Mayaguez.

[2] Supervisory physical scientist, Branch of Foreign Data.

[3] Where necessary, values have been converted from Canadian dollars (Can$) to U.S. dollars at the rate of Can$1.18=US$1.00, the average exchange rate for 1979.

[4] Does not include the value of uranium production, which was not available.

The Mineral Industry of Chile

By Charles Hoyt[1]

During 1978-79 Chile retained its dominant role as one of the world's leading metal producers. It continued to rank second in world production of copper, rhenium, and iodine. In addition Chile is a significant producer of iron ore, molybdenum, natural nitrates, and vanadium. In the 1978-79 period the Chilean economy, as a result of the economic stabilization program initiated in 1975 and sharply rising copper and molybdenum prices in 1979, registered strong gains. Real gross domestic product in 1977 dollars[2] increased about 7% in 1979 compared with 1978, and the indices of industrial wages in 1978 and 1979 were 131 and 119 (1977=100). Specifically in 1979 Chile posted a balance of payments surplus of about $930 million and substantially increased its foreign exchange reserves to $2.5 billion compared with $1.6 billion in 1978. An important factor in this 1979 surplus was higher prices for copper exports, which were valued at over $1.8 billion compared with $1.2 billion in 1978. Despite this major increase in copper exports value, copper's share of total exports increased modestly in 1979 to about 52% compared with about 49% in 1978. This shows the progress of Chile's export diversification program since traditionally copper has represented 70% to 80% of the total exports.

Despite this export diversification, copper mining remains the dominant factor in Chile's economy, and the state-owned copper mining corporation, Corporacíon del Cobre (CODELCO) is by far the largest Chilean corporation, having assets in excess of $2 billion with current annual sales of $1.2 to $1.5 billion. It is over twice as large as the second largest firm, the national electric company, Empresa Nacional de Electricidad, S.A. (ENDESA).[3]

From January 1974 through August 11, 1978, there were almost $2.5 billion in foreign investments in Chile, of which nearly 90% were in mining projects. The leading foreign investors were the United States (67%) and Canada (24.4%).[4] Investment in mining is expected to increase substantially in the next few years as the long-range expansion program of Exxon in the Disputada de las Condes copper mine and envisaged development of the Quebrada Blanca copper deposit by U.S.-Canadian firms and others are realized. In the 1978-79 period the major event in the energy area was the startup of offshore petroleum production in the Magellan Straits Fields. By the mid-1980's, it is expected that domestic petroleum output will approach 60% of domestic needs, compared with about one-quarter at present.

Government Policies and Programs.—In 1978-79 the Chilean Government continued its major program initiated in March 1977 (Foreign Investment Statute, Law-Decree No. 1748) to encourage foreign investment in their economy. Although the Chilean Government plans to retain Government control over the existing mineral operations in copper, coal, nitrates, and iron ore, it is looking to private capital to expand output in copper and petroleum and natural gas developments and in some other areas. Numerous large-scale mining sector investment commitments (primarily copper) have been made. These are highlighted in the Metals section. ODEPLAN, the state planning authority, published a development plan for 1978-83 which continues the existing economic policies to foster resource development and place foreign investors on almost the same basis as Chilean investors. In the public investment plan for 1978-83, total public expenditures in excess of $7 billion are projected, of which the direct mineral and energy share was slightly over $1.4 billion distributed among large-scale copper mining (60.5%), coal-oil-gas (33%), and other minerals (6.5%).

In mid-1979 the Chilean Department of Mining began work on a 5-year program to develop a $5 million national registry of mines (estimated at 14,000 concessions) which would establish location and concession boundaries as well as categorize type and reserves of each concession. This plan hopes to minimize future litigation and foster further foreign investment if titles are clear. The survey covered 250 concessions in 1978 and 1,200 more in 1979. In 1979 the Chilean Government concluded technical cooperation and/or economic agreements with seven nations including Mainland China and also made an agreement with Egypt that provides for petroleum sales to Chile.

Mining investments in Chile receive no special tax concession, and there are no tax preferences given to domestic producers over foreign investors. A foreign mineral investor may choose between a tax rate of a fixed 49% for 10 years or a varying tax structure that in 1978 amounted to 49.5%, which is the rate paid by the state entities (CODELCO, etc.).

PRODUCTION

The increase in copper production in 1979 from 1978 resulted from gains in three of the four CODELCO mines. Molybdenum, a byproduct of copper mining, attained a peak level in 1979 as a result of efforts for improved recovery. The continued decline in onshore production of petroleum was more than made up by an increase in offshore production in the Straits of Magellan. But domestic production met only 23% of domestic consumption; this figure may increase to 35% by yearend 1980. Although a great deal of attention is being given to developing Chile's coal resources and expanded production, production in 1978 and 1979 continued to decline. Coal production for 1980 is estimated at 1.6 million tons, 400,000 tons below estimated demand.

Table 1.—Chile: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Copper:				
Mine output, metal content[2]	1,005,200	1,056,200	1,035,500	[3]1,060,600
Metal:				
Smelter, primary[4]	856,300	888,400	927,400	[3]946,900
Refined:[5]				
Fire, primary refined	141,700	[e]146,700	[e]157,300	161,100
Electrolytic	490,300	[e]529,300	[e]591,800	618,000
Total	632,000	676,000	749,100	[3]779,100
Gold, mine output, metal content troy ounces	[r]129,172	116,376	102,416	105,000
Iron and steel:				
Ore and concentrate thousand tons	10,055	7,896	9,666	8,600
Pig iron do.	403	432	539	[3]611
Ferroalloys:				
Ferromanganese	8,301	4,267	[e]4,000	3,600
Silicomanganese	1,550	283	[e]250	700
Ferrosilicon	4,480	3,168	[e]3,000	2,700
Other	685	886	[e]1,000	1,000
Total	15,016	8,604	[e]8,250	8,000
Crude steel[6] thousand tons	480	548	598	[3]657
Semimanufactures (hot-rolled)	[r]324	395	446	600
Lead, mine output, metal content	1,816	876	431	1,000
Manganese ore and concentrate	23,639	18,001	23,243	22,680
Mercury 76-pound flasks	13	20	--	--
Molybdenum, mine output, metal content	10,899	10,938	13,196	12,700
Selenium kilograms	15,041	8,297	8,165	8,160
Silver thousand troy ounces	7,342	8,461	8,210	8,322
Vanadium, mine output, metal content	1,066	860	689	454
Zinc, mine output, metal content	[r]5,035	3,918	1,814	1,000
NONMETALS				
Barite	21,243	65,038	182,320	181,400
Borates, crude, natural	3,432	4,248	26,544	27,200
Cement, hydraulic thousand tons	[r]968	1,140	1,203	[3]1,359

See footnotes at end of table.

Table 1.—Chile: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Clays:				
Kaolin	66,735	55,712	48,117	45,400
Other (unspecified)	44,079	77,086	80,986	81,000
Diatomite	330	480	5,008	4,900
Feldspar	823	2,452	903	900
Gypsum:				
Crude	65,079	147,404	174,143	[3]162,482
Calcined	56,843	56,447	48,601	[3]54,917
Iodine, elemental	1,423	1,856	1,922	2,180
Lime, hydraulic[e] thousand tons	600	620	620	635
Nitrogen: Natural crude nitrates:				
Sodium	491,415	482,110	422,975	[3]621,300
Potassium enriched	127,565	81,160	106,670	
Phosphates: Gunno	16,107	7,017	[e]7,000	7,000
Pigments, mineral, natural: Iron oxides	6,941	8,146	5,563	6,000
Potash, K_2O equivalent	14,859	[e]16,000	[e]17,000	15,000
Pumice (includes pozzolan)	98,681	158,938	182,526	180,000
Quartz, common	158,195	169,771	194,443	200,000
Salt, all types	427,766	424,165	393,499	390,000
Sodium compounds:				
Sodium carbonate[e]	9,000	9,900	10,800	10,800
Sodium sulfate[7]	42,891	44,358	45,783	69,000
Stone:				
Limestone thousand tons	1,723	1,873	2,188	2,200
Marble	423	1,413	7,552	8,000
Sulfur:				
Native, other than Frasch:				
Refined	16,334	4,967	13,520	5,000
Caliche	1,428	26,942	18,109	20,000
Byproduct (from industrial gases)	30,079	28,662	20,709	30,000
Total	47,841	60,571	52,338	55,000
Talc	1,109	427	432	435
MINERAL FUELS AND RELATED MATERIALS				
Coal, bituminous and lignite thousand tons	[r]1,300	1,342	1,148	[3]921
Coke:				
Coke oven do.	214	[e]215	[e]215	190
Gashouse[e] do.	5	5	5	5
Gas, natural:				
Gross million cubic feet	248,318	237,273	217,776	250,000
Marketed do.	141,858	133,857	123,588	142,000
Natural gas liquids:				
Condensate thousand 42-gallon barrels	686	NA	NA	NA
Natural gasoline do.	918	NA	NA	NA
Liquefied petroleum gas do.	2,887	NA	NA	NA
Total do.	4,491	[e]4,400	[e]4,400	4,400
Petroleum:				
Crude do.	8,371	7,119	6,281	[3]9,855
Refinery products:				
Gasoline:				
Aviation do.	75	98	106	100
Motor do.	[r]8,091	7,880	8,488	8,500
Jet fuel do.	937	1,080	1,082	1,100
Kerosine do.	2,843	2,666	2,670	2,700
Distillate fuel oil do.	6,396	6,535	6,736	7,000
Residual fuel oil do.	7,712	9,315	10,182	10,300
Other:				
Liquefied petroleum gas do.	--	2,506	2,793	2,700
Unspecified do.	5,296	1,268	1,558	1,500
Refinery fuel and losses do.	1,251	1,233	1,233	1,200
Total do.	32,581	32,581	34,848	35,100

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, lime and pyrites are also produced, but available information is inadequate to make reliable estimates of output levels.

[2] Figures are the nonduplicative copper content of ores, concentrates, precipitate, metal, and other copper-bearing products measured at the last stage of processing as reported in available sources.

[3] Reported figure.

[4] Figures are total blister and equivalent copper output including that blister subsequently refined in Chile and copper produced by electrowinning.

[5] Figures are total refined copper distributed into 2 classes according to method of refining.

[6] Excludes castings.

[7] Includes natural sodium sulfate and anhydrous sodium sulfate, coproducts of the nitrate industry.

TRADE

Preliminary data indicated that Chile showed a dramatic increase of 40% in the value of its total exports in 1979, estimated at $3.5 billion compared with about $2.5 billion in 1978. This resulted in a balance of payment surplus of about $930 million despite current account deficit of $911 million. This performance was partially based on an increase in copper prices (about 44%) and an increase in copper tonnage exported (estimated at 1,012,000 metric tons compared with 977,800 metric tons in 1978). Increases in molybdenum export and higher molybdenum prices were also contributing factors.

Like all petroleum-importing countries, Chile suffered from price increases; the cost of petroleum imports increased from $430 million in 1978 to $770 million in 1979 and is projected at $1 billion in 1980 based on imports of about 30 million barrels.

Table 2.—Chile: Exports of copper and iron ore

(Metric tons unless otherwise specified)

Commodity and destination	1976	1977	1978
Copper ore and concentrate, Cu content:			
Canada	5,700	---	9,700
China (Taiwan)	2,100	10,700	5,900
Germany, Federal Republic of	22,400	32,300	20,100
Japan	57,700	65,100	56,500
Korea, Republic of	9,200	17,600	8,100
Spain	24,700	20,800	11,400
Other	34,400	24,500	700
Total	156,200	171,000	112,400
Blister copper:			
China, Mainland	22,900	12,000	15,300
Germany, Federal Republic of	83,200	71,300	51,200
Japan	9,200	10,500	7,400
Spain	18,000	18,900	12,200
United Kingdom	30,100	22,200	17,600
United States	35,600	41,800	35,900
Yugoslavia	12,700	17,500	10,600
Other	19,300	22,500	13,100
Total	231,000	216,700	163,300
Refined copper:			
Argentina	19,000	34,900	28,300
Belgium-Luxembourg	27,200	32,300	30,500
Brazil	143,200	156,600	115,200
France	41,700	31,500	27,100
German Democratic Republic	11,000	1,400	6,100
Germany, Federal Republic of	84,700	77,500	97,500
Italy	71,300	64,400	87,400
Japan	32,200	34,700	69,800
Sweden	12,500	7,000	11,200
United Kingdom	56,000	47,200	67,000
United States	63,600	101,700	117,700
Other	32,300	28,300	44,300
Total	594,700	617,500	702,100
Iron ore, gross weight:			
Argentina ____ thousand tons	112	169	NA
Belgium-Luxembourg ____ do	615	200	NA
Germany, Federal Republic of ____ do	216	---	NA
Japan ____ do	7,476	6,765	NA
United States ____ do	518	556	NA
Total ____ do	8,937	7,690	6,690

NA Not available.

Table 3.—Chile: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite	2,662	NA	
Oxide and hydroxide	567	1,554	United Kingdom 1,297; United States 214; West Germany 36.
Metal including alloys:			
Unwrought	3,237	4,269	United States 1,195; Norway 1,182; Canada 1,055.
Semimanufactures	1,299	2,241	Brazil 660; West Germany 509; United States 424.
Antimony metal including alloys, all forms	17	27	Bolivia 9; United Kingdom 7; Switzerland 5.
Arsenic trioxide, pentoxide, acids	134	425	United States 219; United Kingdom 160; Belgium-Luxembourg 19.
Chromium:			
Chromite	4,112	5,959	United States 5,000; Republic of South Africa 919; Netherlands 40.
Oxide and hydroxide	22	43	West Germany 32; United States 9; United Kingdom 2.
Cobalt oxide and hydroxide	12	9	Mainly from Belgium-Luxembourg.
Copper:			
Ore and concentrate	--	101	All from Bolivia.
Metal including alloys, all forms	178	343	Japan 230; United States 40; West Germany 35.
Gold ore and concentrate thousand troy ounces	212	672	All from Bolivia.
Iron and steel metal:			
Scrap	10,429	7,358	United States 3,410; Republic of South Africa 1,299.
Pig iron, ferroalloys, similar materials	990	1,340	Republic of South Africa 465; Brazil 320; United States 249.
Steel, primary forms	2,295	2,577	Republic of South Africa 1,435; United States 800; Japan 286.
Semimanufactures:			
Bars, rods, angles, shapes, sections	3,904	8,279	Japan 3,139; West Germany 2,599; Republic of South Africa 1,185.
Universals, plates, sheets	10,304	35,990	Japan 28,782; United States 2,963; Austria 1,621.
Hoop and strip	5,754	5,167	Japan 2,895; United States 795; West Germany 711.
Rails and accessories	3,819	914	West Germany 418; United States 350; United Kingdom 114.
Wire	1,267	1,480	Japan 334; West Germany 276; Peru 246.
Tubes, pipes, fittings	12,999	4,673	United States 1,339; Japan 877; West Germany 648.
Castings and forgings, rough	2,150	4,591	West Germany 2,117; Belgium-Luxembourg 1,168; United States 268.
Lead:			
Oxides	11	65	Peru 62; United Kingdom 3.
Metal including alloys:			
Unwrought	2,051	1,746	Peru 1,298; Mexico 200; Argentina 131; United States 109.
Semimanufactures	685	38	Argentina 22; United Kingdom 6; France 4.
Manganese:			
Ore and concentrate	1,516	NA	
Oxides	174	48	Japan 46; Netherlands 2.
Mercury 76-pound flasks	603	743	United States 374; West Germany 215; Mexico 90.
Nickel:			
Matte, speiss, similar materials	5	(1)	NA.
Metal including alloys;			
Unwrought	54	130	France 103; United States 11; Canada 9.
Semimanufactures	47	65	West Germany 15; United States 13; France 10.
Rare-earth metals, oxides	3	2	West Germany 1; United States 1.
Tin:			
Oxides	3	3	Mainly from United Kingdom.
Metal including alloys, all forms	339	580	Bolivia 311; United States 196; Switzerland 28.
Titanium oxides	443	345	West Germany 272; Belgium-Luxembourg 49.
Tungsten metal including alloys, all forms	86	(1)	NA.
Zinc:			
Oxide	35	22	West Germany 17; Peru 2; United States 2.
Metal including alloys:			
Unwrought	3,488	5,560	Peru 2,992; Canada 2,029; United States 215; Mexico 204.
Semimanufactures	31	71	United States 30; United Kingdom 22; Brazil 9.

See footnotes at end of table.

Table 3.—Chile: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Other:			
Ores and concentrates	55	1,745	French Guiana 1,610; Australia 78; United Kingdom 28.
Oxides, hydroxides, peroxides of metals	55	50	United States 19; West Germany 13; Netherlands 8.
Metals including alloys:			
Alkali, alkaline earth, rare-earth metals, n.e.s	1	(1)	NA.
Pyrophoric alloys	7	(1)	NA.
Base metals including alloys, all forms, n.e.s	88	64	Republic of South Africa 32; United States 18; United Kingdom 12.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	24	82	West Germany 45; United States 36; Netherlands 1.
Dust and powder of precious and semiprecious stones kilograms	217	(1)	NA.
Grinding and polishing wheels and stones	385	356	Brazil 154; United States 73; Argentina 26.
Asbestos	8,245	9,324	Canada 7,107; Republic of South Africa 1,148; United States 1,050.
Barite and witherite	--	19	All from Peru.
Boron materials, oxide and acid	434	32	United Kingdom 30; West Germany 1.
Cement	2,063	2,256	United States 811; France 562; Argentina 268.
Chalk	3	63	United States 33; Argentina 30.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	3,708	2,430	Argentina 1,3[illegible] United States 760.
Kaolin	1,605	1,617	United States 1,[illegible] Brazil 252; West Germany 202.
Other	255	581	United States 497; Argentina 30; United Kingdom 25.
Products:			
Refractory (including nonclay brick)	7,505	24,725	Austria 9,223; United Kingdom 7,466; United States 6,296.
Nonrefractory	1,396	4,589	Brazil 1,596; Spain 994; Italy 965.
Cryolite and chiolite	--	3	All from Denmark.
Diamond, industrial carats	21,710	128,880	United States 66,025; United Kingdom 50,250; Canada 12,600.
Diatomite and other infusorial earth	46	120	Mexico 94; United States 26.
Feldspar	150	--	
Fertilizer materials:			
Crude and manufactured:			
Nitrogenous	22,657	41,887	United States 18,585; France 12,022; Japan 4,603.
Phosphatic	137,037	98,431	United States 95,681; Mexico 2,250; Belgium-Luxembourg 500.
Potassic	15,154	25,656	United States 15,172; Canada 10,472.
Other, including mixed	2,552	1,244	West Germany 1,145; United States 31; Belgium-Luxembourg 31.
Ammonia	296	131	Netherlands 75; Argentina 26; West Germany 19.
Fluorspar	4,672	3,861	Mexico 3,064; Brazil 515; Argentina 161.
Graphite, natural	138	42	West Germany 31; Republic of South Africa 8.
Gypsum and plasters	141	229	Mainly from West Germany.
Lime	91	24	All from Argentina.
Magnesite	3,655	3,072	Brazil 1,807; Japan 1,100; Austria 137.
Mica, all forms	19	27	United States 14; Brazil 3; West Germany 3.
Pigments, mineral:			
Natural, crude	--	92	Mainly from United States.
Iron oxides, processed	175	136	West Germany 101; Argentina 33; United States 2.
Precious and semiprecious stones, except diamond:			
Natural carats	7,165	53,685	West Germany 45,150; United States 8,535.
Manufactured do.	26,435	--	
Salt and brines	310	67	Argentina 21; West Germany 16; United Kingdom 15.
Sodium and potassium compounds, n.e.s.	3,598	6,546	United States 4,061; Romania 581; Netherlands 566.
Stone, sand and gravel:			
Dimension stone	224	328	Italy 169; Canada 82; Belgium-Luxembourg 51.
Dolomite, chiefly refractory grade	8,665	15,269	Argentina 13,649; Uruguay 1,594.

See footnotes at end of table.

Table 3.—Chile: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Stone, sand and gravel —Continued			
Gravel and crushed rock	45	113	Belgium-Luxembourg 101; West Germany 12.
Quartz and quartzite	49	139	Sweden 88; Argentina 30; Switzerland 16.
Sand, excluding metal bearing	8	13	Bolivia 5; United States 4; Japan 3.
Sulfur:			
Elemental:			
Other than colloidal	66,490	90,024	Canada 43,067; United States 29,951; Bolivia 14,237.
Colloidal	106	117	United States 109; West Germany 8.
Sulfur dioxide	(1)	20	All from West Germany.
Sulfuric acid	12	14	West Germany 9; United States 4; France 1.
Talc, steatite, soapstone, pyrophyllite	562	446	Finland 240; Argentina 121; Italy 50.
Other:			
Crude	378	894	United States 364; Argentina 261; Mexico 119.
Slag, dross, and similar waste, not metal bearing	470	866	United Kingdom 560; United States 276; West Germany 30.
Oxides and hydroxides of magnesium, strontium, barium	139	338	Japan 190; United States 111; West Germany 27.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	176	325	United States 186; Argentina 38; Belgium-Luxembourg 35.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,182	618	United States 412; West Germany 143; United Kingdom 54.
Carbon black	8,104	8,868	Colombia 5,058; Mexico 1,658; United States 1,262.
Coal, all grades, including briquets	179,246	172,568	United States 123,849; Canada 47,380; Brazil 1,229.
Coke and semicoke	70,949	118,182	Japan 111,025; Netherlands 5,418; United States 1,125.
Hydrogen, helium, rare gases	46	29	Mainly from United States.
Peat, including briquets and litter	28	30	West Germany 28; United States 2.
Petroleum:			
Crude ___ thousand 42-gallon barrels	20,619	25,902	Iran 10,155; Venezuela 9,203; Ecuador 4,765.
Refinery products:			
Lubricants ___ do	11	15	United States 11; West Germany 2.
Mineral jelly and wax ___ do	116	149	United States 63; Argentina 47; West Germany 15.
Liquefied petroleum gas ___ do	864	666	Mainly from Argentina.
Bituminous mixtures, n.e.s ___ do	6	1	NA.
Other ___ do	6	15	Argentina 7; United States 6.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,570	1,481	Netherlands Antilles 965; United States 288; Peru 188.

NA Not available.

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Copper.—Mine production of copper dropped in 1978 primarily because of declining ore grades, but it was projected to increase in 1979 because of production gains in three of CODELCO's mines. The long-term outlook for Chilean copper production is excellent because of the country's enormous copper reserves, increased foreign investments, and rising world prices for copper.

Extensive foreign investments were made in Chile's copper industry in 1978-79. The largest single investment was Exxon Minerals Chile, Inc.'s $110 million purchase of the La Disputada de las Condes Mining Company (Compañía Minera Disputada de Las Condes, S.A.), which operates the La Disputada and El Soldado copper mines. The purchase contract specifies that Exxon may invest $1.2 billion to expand current ore production of 4,800 tons to an ultimate capacity of 80,000 tons per day by the late 1980's. Exxon's immediate plans were to increase mill capacity to 8,400 tons per day. Another major feasibility program underway in 1978-79 is the Quebrada Blanca project in which a U.S.-Canadian consortium (Falconbridge Nickel Mines Ltd., The Superior Oil Company, Ltd., and McIntyre

Mines Ltd.) is considering a $500 million investment. The Anaconda Company also invested in Chile by the $20 million purchase of the Los Pelambres deposit near the Argentine border northwest of Santiago. The deposit has ore reserves in excess of 400 million tons with indicated grades of 0.78% copper and 0.033% molybdenum. A $12 million investigation program is underway to determine suitable levels of output. Capital investments as high as $1.2 to $1.5 billion are under consideration. Another major copper development that was finalizing in late 1979 was the Andacollo copper project, which has been under investigation since late 1977 by Noranda Mines Ltd. In mid-1979 Noranda and Empresa Nacional de Mineria (the Chilean state mining corporation) announced plans to jointly mine the Andacollo deposit. The planned mine-mill complex would produce 70,000 metric tons of copper with an estimated capital investment of $350 million. Another important private foreign investment copper project with potential capital investments of $80 million by Compania Minera San Jose, Inc., a subsidiary of St. Joe Minerals Inc., intended development of the gold-silver-copper deposit known as El Indio located about 100 miles east of La Serena. Mid-1979 reports indicate reserves of 2.2 million tons grading 2.8% copper, 0.5 troy ounce of gold per ton, and 4.4 troy ounces of silver per ton. The mine would be developed over a 2-year period.

The state copper mining corporation, CODELCO, that produces over 85% of Chile's copper output, has extensive plans for major capital investment programs at their four large mines that are both underway and in feasibility studies. CODELCO reportedly has an investment program of $892 million for 1978-82 and was expected to invest about $170 million in 1979 and up to $245 million in 1980. Investments in Chuquicamata include an expansion of concentrating capacity ($50 million), new crushing and conveyor facilities ($120 million), and equipment replacement ($15 million). Conversion to trucks from rail haulage has already taken place. At the El Teniente operation, similar major investments are underway, with infrastructure ($40 million), concentrating treatment expansion ($12 million), and tailings dump expansion ($80 million) all underway. The CODELCO smelter operations, El Salvador and Andina, also have major expansions underway. At El Salvador these programs include a 20% to 30% crushing and concentrating expansion ($30 million), smelter modernization ($11.5 million), and electrolytic refinery construction ($6.5 million). At Andina the current expansions are a wash plant ($30 million) and a new tailings disposal site ($33 million).

Iron Ore.—Iron ore production increased substantially in 1978 because of increased activity in the El Algarrobo Mine, which had to provide ore to the $250 million Huasco Valley project, Chile's first iron ore pelletizing complex and one of the world's largest. This plant was inaugurated in March 1978. The first shipment of self-fluxing pellets was made to the Ogishima works of the Japanese firm Nippon Kokan K.K. A 10-year contract has been made with the Mitsubishi Corporation for almost the entire output of this plant (33 million tons over 10 years). Mitsubishi also reportedly provided over $112 million of the total financing for the project. Almost 1.9 million tons of pellets were produced and 1.6 million tons (65% Fe, 0.5% P, and 0.3% S) were shipped in 1978, and it was expected to get the plant up to full capacity in 1979. Cia. de Acero del Pacifico S.A. (CAP) operates three surface iron ore mines: El Agarrobo, which provides feed to the pellet plant, El Romeral, and Santa Fe. In 1979 the El Romeral Mine, located in northern Chile near La Serena, celebrated its 25th year of operation. An excellent comprehensive article describing this mine appeared in a trade journal[8] during 1979. In 1978 production at El Romeral declined to under 3 million tons, and output at the Santa Fe Mine dropped to under 2 million tons.

Iron and Steel.—Expanding domestic consumption of steel provided the impetus to increase CAP's 1978 semifinished product steel output 13% over that for 1977.

Steel shipments for 1978 from the Huachipato steel mill were almost 392,000 tons, of which 94% was consumed in Chile. A similar increase is expected in 1979. Improvements at the Huachipato installation included a new 4-high mill that in mid-1979 replaced the old reversing mill. The new mill will improve the yields and quality of hot and cold rolled coils, sheets, and tinplate.

In mid-1978, an important 1-year critical analysis by Japanese technicians of all the Huachipato operations with specific recommendations was under intensive review and implementing by CAP management.

Manganese.—Although production of manganese ore increased slightly, the average grade dropped from 39% to 36%. The entire production was from the Coquimbo Region. Manganesos Atacama, S.A., also produced modest tonnages of ferromanganese and manganese dioxide.

Molybdenum.—In 1978-79 Chile continued to be the world's third largest molybdenum producer and attained its highest production level in 1978. Similar levels of output from the four CODELCO mines are anticipated in 1979. Owing to major price increases in 1979, the value of Chile's molybdenum exports totaled $350 million. CODELCO's Chuquicamata and El Teniente mines contain the highest molybdenum reserves and average about 0.04% molybdenum. Chile's molybdenum is processed into molybdic oxide and ferromolybdenum and sold in this form. In the mid-1970's, CODELCO operated two molybdenite roasters with a productive capacity of about 6,000 metric tons per year of molybdic oxide. Further expansions are underway, and it was announced that a new roasting plant will be completed in 1980 at Chuquicamata.

Several foreign mining firms (Amax, Inc. and Noranda) are reportedly exploring in Chile for possible molybdenum deposits that could be mined for their own value, rather than as a byproduct of copper mining.

Precious Metals.—Most of Chile's precious metal output comes from byproducts in copper processing. In 1978, 77% of mine gold was from this source. Silver production remained at over 8 million ounces in 1978 and was expected to stay at this level in 1979. There was a substantial increase in silver from silver ores (14.6% of total in 1979 compared with 6.6% in 1978), but the increases did not compensate reduced production from both copper and lead-zinc ores.

Uranium.—Over the past several years laboratory and pilot studies have been conducted under the direction of the Chilean Nuclear Energy Commission, Comisión Chilena de Energía Nuclear (CCEN), to recover uranium from the copper leach solutions from the Exotica Mine using ion exchange methods. These tests have concluded that it is feasible to commercially recover the uranium, and consideration is now underway as to what methods to use. On September 16, 1976, the Chilean Government approved a new law, Decree Law 1557,[6] concerning the organization of CCEN and the exploration, exploitation, and processing of natural radioactive materials. This allows private firms to enter into contracts with the Commission to explore and exploit these materials. In 1975-78 the United Nations Development Program worked with the Chilean Government to explore seven areas where uranium occurrences were known. The Government of Chile reportedly feels that the country does possess considerable uranium resources. In 1979 Essex Minerals Co., a subsidiary of U.S. Steel Corp., Union Oil Co. of California, and Wyoming Mineral Corp., a subsidiary of Westinghouse Electric Corp., were reportedly discussing an operations contract with CCEN, with marketing of the yellow cake reserved to the Commission. As a part of its overall energy development program, there are provisional plans to construct a 600-megawatt nuclear powerplant by the late 1980's.

NONMETALS

Iodine.—Chile retained its role as the world's third largest iodine producer in the 1978-79 period, and output of iodine increased significantly from over 1,922 tons in 1978 to an estimated 2,300 tons in 1979. This maintained the upward trend begun in 1977 when 1,856 tons were produced. A new iodine plant is being built at María Elena which will come into production in 1980.

Lithium.—It is estimated that Chile accounts for almost half of the world's lithium reserve base. The Ministry of Mines decreed that future lithium operations will be reserved for the state. Exceptions are provided for those projects approved prior to November 1979 (Decree Law 2866) and include the Foote Mineral Co. lithium carbonate project at the Salar de Atacama. Foote Mineral has conducted feasibility studies to determine the optimum size plant needed to exploit the extensive lithium reserves contained in the potassic-rich brines of the Salar de Atacama. The studies concluded that a $23 million plant will be built with a capacity of 5,500 tons per year of lithium carbonate and 10,000 tons of magnesium oxide, generating an estimated annual sales revenue of $12 million. For this operation a joint venture has been formed between the Chilean state-owned firm Corporación de Fomento de la Produción (CORFO) and Foote Mineral. The joint venture is called Sociedad Chilena del Litio.

Nitrates.—Nitrate production continued its long-term declining trend in 1978, but recovered in 1979 to an estimated production level of 600,000 tons by the state-owned producer Sociedad Química y Minera de Chile (SOQUIMICH).

Other Nonmetals.—Alternative plans are under consideration to develop other chemicals (potassium salts and boric acid) from the extensive (3,000-square-kilometer) brines of the Salar de Atacama, which is located in northern Chile and is the largest salt deposit in the country. A $130 million plant which would produce annually 770,000 tons of potassium chloride, 250,000 tons of potassium sulfate, and 55,000 tons of boric acid appears to be the optimum choice. In June 1978 the Diamond Shamrock Corporation of Cleveland, Ohio, purchased a chlorine and soda plant at Talcahuano for $14 million from the Sociedad Petroquímica Chilena.

MINERAL FUELS

Coal.—Bituminous coal output in 1979 continued its decline to an estimated 0.9 million tons compared with production of about 1.1 million in 1978 and 1.3 million in 1977. All coal in Chile is produced by the state corporation, Empresa Nacional del Carbon S.A. (ENACAR), which took over all operations in late 1973. Chilean coal output peaked in the mid-1950's at about 2.3 million tons. The industry suffers from overemployment, very deep mines, and thin coal seams that project under the sea. In late 1978, ENACAR reportedly reduced its 14,000 plus workforce by 20% (2,800 workers) in order to place the mines on a profitable basis. Also as part of the Government plan to place the coal mining industry on a profitable basis, plans were announced to close the Schwager Mine (near Concepción) in 1980 because of declining output and high costs. Also in 1978 price controls were removed. The Government continued its feasibility studies considering possible surface mining of the large coal deposits in southern Chile in Magallanes Province. In late 1978 ENACAR announced plans for a $8 million coal exploration program which includes 38,000 meters of drilling in Arauco Province and the Lebu area.[7]

Petroleum and Natural Gas.—Petroleum consumption in 1979 was estimated at about 39 million barrels, 2.6% above that of 1978. Consumption is composed of 33% fuel oils (essentially for the mining sector), 31% fuel oils and kerosine for other industry and the domestic sector, and 26% gasoline for transportation.

Onshore petroleum production in 1978-79 continued its decline; however, Chile's offshore oil production was inititated in January 1979 from the Ostión oilfield, in November from the Spiteful field, and in December from the Posesión field, all located in the Magellan Straits. The production platforms in these fields helped raise Chile's 1979 output to almost 10 million barrels compared with 6.3 million barrels in 1978. The newly discovered offshore oilfields in the Magellan Straits of Ostión Spiteful, Anguila, Posesión, and Jaiba will be exploited and further explored from 20 drilling platforms that are being or will be built. Past expenditures for this program have been over $90 million, and another $110 to $150 million will be required for full production. In 1980 output is anticipated to reach 14 million barrels when two additional platforms come into production in the Anguila and Jaiba fields. This will be about 35% of 1980 domestic needs. By the mid-1980's domestic production may meet 60% of Chile's requirements. Further future offshore oil output is expected from Chacao Canal field near Chiloé Island presently being jointly explored by an Atlantic Richfield Co. (ARCO)-Empresa Nacional del Petróleo (ENAP) joint venture and by an ARCO-Amerada Hess Corp.-ENAP project in the Magellan area. Since the first offshore exploration contract signed with foreign companies in November 1977, two extensive offshore tracts have been explored and/or exploited. The first extends roughly south from latitude 40° S to 48° S and is being explored by ARCO and Amerada Hess. The first exploration well on this tract started in November 1979 west of Chiloé Island. The second tract is in the extreme south of Chile and covers the coastal waters from about latitude 51° 30′ S further south and eastward along the coast to almost the border with Argentina. This lease is with Amerada Hess, ARCO, and Phillips Petroleum Co.[8]

Chile also has discovered potentially important natural gas resources in the Concepción area at Isla Mocha. ENAP has concluded initial geological studies and conducted exploration drilling during 1979. Preliminary estimates indicate the gas supplies could be sufficient to satisfy the entire Concepción region's needs.[9]

In October 1978 the U.S. firms ARCO and Air Products and Chemicals Inc. signed an agreement to investigate the feasibility of exploiting and exporting natural gas from the Magallanes area. To exploit this gas, a new firm, Gas de Chile, LTDA was formed jointly by ARCO, Air Products and Chemicals Inc., Compañía Petróleos de Chile (COPEC), and ENAP. Plans and feasibility studies are underway to construct a $400 million liquid natural gas project at Cabo Negro in the Magallanes area. Current plans call for the liquefying of about 7 million cubic meters of gas daily.

Other.—In recent years Chilean scientists and engineers have been studying the country's potential for geothermal energy exploitation in northern Chile. The first commercial geothermal powerplant was approved in 1979 and is under construction about 100 kilometers east from Chuquicamata at El Tatio in El Loa Province. Plans call for an investment of $30 million with an initial installed capacity of 30,000 kilowatts and an eventual capacity of 120,000 kilowatts. It is hoped this plant will eventually satisfy all of the copper mining requirements at Chuquicamata.

Another important geothermal development underway in northern Chile is located at Puchuldiza near the Bolivian border east of Pisagua. As of mid-1979 five wells had been drilled, and the eventual power capacity of the area is estimated at 150,000 to 180,000 kilowatts. The initial power output will be 45,000 kilowatts and operation is expected to begin in 1983. Total capital investment should be in excess of $64 million.[10]

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Exchange: December 1978, US$1.00=Chilean peso $33.95; December 1979, US$1.00=Chilean Peso $39.00.

[3] Chile Economic News. December 1977, No. 81, p. 8.

[4] Chile Economic News. January 1979, No. 94, pp. 4-6.

[5] Skillings' Mining Review. Aug. 11, 1979, pp. 10-14.

[6] Bureau of Mines. Mineral Trade Notes. V. 74, No. 3, March 1977, pp. 16-36.

[7] Chile Economic News. September 1978, No. 90, pp. 6-7.

[8] Chile Economic News. January 1980, No. 106, pp. 2-4.

[9] Chile Economic News. November 1979, No. 104, p. 8.

[10] Chile Economic News. October 1979, No. 103, p. 10.

[illegible]

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The Mineral Industry of China[1]

By K. P. Wang[2]

China's total gross national product (GNP) surpassed $425 billion in 1978, placing China solidly among the top six countries of the world. The Chinese themselves claim 569 billion Yuan (or RMB)[3] as the combined industrial and agricultural output for 1978. Per capita GNP remained very low, compared with those of western nations, but lower food, housing, and transportation costs result in a stronger economy and higher standard of living than the per capita GNP figures suggest. China's GNP has been growing at an annual rate of up to roughly 10% in recent years, although much less in 1976 when both Mao Tze-Tung and Chou En-Lei passed away from the political scene. It was officially reported that China's industrial output in 1978 was over $250 billion, or 13.5% more than in 1977.[4] Minerals and metals together contributed considerably more than 10% of China's 1978 GNP. The country's GNP in 1979 was at least $450 billion.

While 1977 was the year of return to normalcy and crusade against the "gang of four," 1978 was one of greatly improved utilization of plant capacity and unfolding of industrialization plans and modernization policies, particularly with regard to accelerating development with foreign help. China's decision to modernize quickly had its origins in concepts initially expressed by Chou En-Lai. However, Chairman Hua Kuo-Feng made a strong affirmation of this pragmatic approach to economic development and foreign trade when he stated in mid-1978 to a National Conference on Finance and Trade in Peking that China must learn from the experience of advanced countries. China overextended its financial resources in the haste to industrialize, so 1979 became a year of consolidating enterprises, readjusting priorities, and delaying major foreign projects.

Normalization of relations between China and the United States finally was resumed on January 1, 1979, with Vice Premier Teng Hsiao-Ping visiting Washington on January 29 and the two countries exchanging ambassadors on March 1, 1979.

Production started to pick up early in 1978, generally approached known capacities by midyear, and finally established records in many instances by 1979. Major achievements announced for 1978 included the production of 31.8 million metric tons of steel, over 65 million tons of cement, 618 million tons of coal, and 48 million tons of chemical fertilizers. Output levels were clearly higher in 1979. In March 1978, Chairman Hua Kuo-Feng revealed that China had planned over 100 major projects by 1985. There was also a flurry of vaguely reported substantial geological finds, coupled with requests for foreign experts to examine them. The number of Chinese visits abroad and foreign visits to China to discuss specific projects greatly increased, especially during the second half of 1978. In midyear, the United States sent a high-level Government technical delegation to China, which no doubt will play a valuable role in facilitating future exchanges. However, after a hectic period of contract talks with foreigners, China reached a pause stage by March 1979 to review various programs. It became evident that the modernization efforts would be scaled down and the schedule moved back as much as 5 years, in line with China's financial capabilities.

China's recent disclosure that it had very extensive reserves of 17 minerals, including coal, oil, iron, copper, tungsten, tin, manganese, antimony, molybdenum, salt, magnesite, limestone, fluorspar, and phosphates, became increasingly substantiated as fragmented details of major finds were announced. The known strong position in coal was consolidated by specific mention of at least five major coal bases - Yenchou (Yanzhou) in Shandong, Kuchiao (Gujiao) in Shanxi, Huolinho in Jilin, Yiminho in Heilongjiang, and Antaipao in Shanxi. The oil outlook was much improved by various finds nearshore and offshore (from Hong Kong southwest to Tonkin), north and central China discoveries, and a very important discovery in western Xinjiang. In addition to the Anshan-Chitashan (Jidashan) iron range, another low-grade range was being developed in northern China; various 100-million-ton-plus, high-grade deposits were also reported. Development of a substantial porphyry deposit in Jiangxi proves that China indeed has much copper and molybdenum. Important porphyry molybdenum deposits have also been reported for Jilin and Shanxi Provinces. Large lead-zinc deposits were reported for Qinghai, Yunnan, and Sichuan. New primary reserves have been reported for tin and tungsten in Guangxi. China's supplies of salt, magnesite, limestone, and fluorspar are obviously substantial, and now the potentials for off-grade bauxite and phosphate rock apparently are also good. The country is very strong in rare-earth metals and seems to have some good diamond deposits as well. Recoverable helium occurs in various natural gasfields.

China has made considerable progress towards the goal of generally assessing its overall resource position within 10 years; this information is important in rational planning of industrialization programs. Much more geological surveying and mapping have been done than commonly credited by foreign technicians and observers. Although only large-scale geological maps are available outside China, most of the eastern half of the country has been mapped on a 1:200,000 or more detailed scale, and such maps are only shown to specifically interested parties. The corps of geological and drilling workers has expanded steadily in recent years, and the masses are urged to look for minerals. During 1978, China's geological workers were said to have scored significant achievements in prospecting for oil and gas, coal, high-grade iron ore, copper, tin, tungsten, potash, phosphates, pyrites, various other minerals, and ground-water resources. Geological teams of 17 provinces and political subdivisions broke with tradition and worked all winter. State targets for delineating deposits were fulfilled for 20 major minerals during 1978 and 1979. Large reserves of coal, iron ore, copper, chrome, manganese, tungsten, and pyrites were found. New deposits of 17 lesser minerals, including rutile and fluorspar, were also discovered. Because of successful geological surveys done in areas outside of known ore horizons and major regions, an additional 100 new deposits were reportedly found.

The State Geology Bureau, which became the Ministry of Geology in late 1979 and was scheduled to participate in a technical cooperation project with the U.S. Geological Survey, convened an important geological conference in Shanghai in early 1978, with the objective of identifying sufficient minerals for China's modernization efforts. The conference concluded that China has a bright future even in high-grade iron ore, and that the targets for the number of discoveries should be increased. It further recommended that a special geological and drilling effort should be made to provide data for building 10 "Tachings" or (Deqings). The hope is to find many more coalfields in south China and more underground water resources in drought areas. To step up exploration, new techniques should be utilized to a greater extent, such as aerial surveying, remote sensing, and joint use of geophysical and geochemical exploration concepts. General exploration should be coordinated with detailed investigations. Geological research needs to be stressed, and an effort should be made to develop new technology while improving known practices, according to the State Geology Bureau.

Specifically, many iron deposits were discovered in Yunnan, Sichuan, and Tqinghai Provinces, where the ore is of high grade and the strata are thick and, therefore, worthy of further investigation. Rich oil deposits were found in Jiangsu and Guangdong Provinces, and a number of new coalfields were discovered in Jiangxi, Fujian, Hunan, Hubei, and Guangxi Provinces. The State Geology Bureau further reports that new phosphate horizons occur in places like Inner Mongolia and Liaoning that warranted additional prospecting. Underground water was found in arid and semiarid areas of northern China. Good progress was made in the search of complex deposits of nonferrous metals in the southwest. China's saline lakes (many dry ones) were carefully examined. It was also reported that Weisancheng in Henan Province, with high-grade ores, was China's foremost silver mine.

During 1978 and early 1979, the following very important mineral discoveries were disclosed by the Chinese: A large tin (also lead-zinc and antimony) mining district in Guangxi, probably near Hochih; a rich tungsten deposit also in Guangxi; three major lead-zinc deposits in Qinghai (Sitiehshan), Gansu (Chengxian), and Sichuan; extensive porphyry copper deposits in eastern Tibet (Yulung-Qamda) and Yuanqu in Shanxi; a cobalt-copper deposit on Hainan Island; a tungsten deposit at Chengxian in Hunan; a very large nickel-copper deposit at Jinchuan in western Gansu; chrome ore associated with platinum in Yunnan and Tibet; and extensive lithium-boron resources in the salt lakes of Tibet.

Of particular interest is a report[3] that a very extensive multiple metals province had been found in the Chinsa-Lanchang-Nuchiang Rivers area straddling Qinghai, Tibet, Yunnan, and Sichuan Provinces. This mineralized area covers 550,000 square kilometers and is 1,900 kilometers from north to south. Geologically located at the intersection of the Indian and Asian tectonic plates, it has undergone various violent structural changes that have developed many mineral concentrations. Reportedly, more than a decade of geological investigations have proven that the area's potential is very good for numerous minerals, including iron, copper, lead, zinc, tin, antimony, mercury, tungsten, molybdenum, rare-earth metals, nickel, platinum, pyrites, potash, mica, asbestos, gypsum, magnesite, and limestone; water, forest, and geothermal resources are also said to be rich. Specific deposits already discovered in this region include a large copper deposit in the Yulung area of Tibet, a very large lead-zinc deposit in the Lanping area of Yunnan, a platinum-palladium deposit in the Mitu, Chinpaoshan (Jinbaoshan) area of Yunnan, and a potash deposit in the Chiangcheng area of Yunnan. Iron and tin are said to be mainly in the south, copper occurs in four parallel belts, and lead-zinc is widely distributed.

Mineral deposits discovered and delineated by the State Geology Bureau (subsequently, the Ministry of Geology) are turned over to the various concerned ministries for production, particularly to the Ministries of Petroleum, Coal Industry, Metallurgical Industry, Chemical Industry, and Construction Materials, which control all the major mineral, fuel, and metal-producing combines of China. In the past, most large projects were developed and operated by these domestic combines, and China's own efforts to industrialize have met with reasonable success across the board. In the latter part of 1978, however, China suddenly started to negotiate many substantial agreements with foreigners to help develop basic industries. This was, in turn, followed by a drastic cutback and delay in the foreign projects.

West German firms have been awarded contracts to develop a 20-million-ton-per-year lignite mine complex in Jilin and six shaft mines in Hebei and Anhui with a combined capacity of 20 to 25 million tons per year of coal, and were also bidding on another low-rank coal mine in Heilongjiang (also 20 million tons per year), possibly against U.S. firms. U.S. firms were also in the running to develop a 20-million-ton-per-year opencut "hard" coal mine complex in Shanxi. The Japanese will definitely be involved in some of the mines in the Yenchou or Yanzhou coalfields of Shandong and the Kuchio or Gujiao coalfields of Shanxi, both of which are to be built up into very large coal bases. It is quite possible that other foreigners will be involved in these two fields also. The Japanese may help develop mines in Hebei and Liaoning as well. British companies have been contracted to help develop two major coal mines in Tatung (Datung), Shanxi, partly to supply a new powerplant to be built in Hong Kong.

In late January 1979, it was reported that China was negotiating with Japanese and U.S. firms for joint development of a newly discovered western Xinjiang oilfield at an initial cost of $1 billion. The news has great uncertainties and vast implications, since this field is thought to be larger than Taching (Daqing) or Shengli (Xengli), and the oil is light rather than waxy. About nine U.S. oil companies were interested in China's offshore oil (and nearshore oil), mainly in the South China Seas but also further north in the East China Seas. Oil has already been found in the Pearl River estuary near Canton, the Leichow Peninsula, the Chiungchow Straits north of Hainan Island, and offshore southwest Hainan in the Tonkin Bay. Various exploration contracts were signed in 1979 with U.S. firms to work some of the above areas offshore. The Japanese were angling to obtain the rights to develop the Samsui oilfield near Canton, as well as the Bohai Bay in the north. British Petroleum will conduct a seismic survey of the Southern Yellow Sea.

In iron and steel, the Shanghai Paoshan or Baoshan project, nurtured by Nippon Steel, is leading the way. The first two stages call for production of 6 million tons per year of steel, with most of the iron ore coming from foreign sources initially. Anshan's capacity is to be more than doubled to about 15 million tons per year eventually. United States Steel got the bid to modernize and expand Chitashan (Jidashan)-Anshan's largest future ore source- to 17 million tons per year of pellets (plus some sinter). At another large proposed steelworks in the north called Chitung (Jidong), West German and Japanese companies, and very likely United States Steel, have been asked to submit bids. Chitung, which is at least the size of the Shanghai steel project, apparently will not be built until after 1985. Nevertheless, Kaiser Engineers was helping to develop the Szechiaying mine for Chitung. Japan's Nippon Kokan seems to have the best chance to work on expanding the Peking Steelworks, and Bethlehem Steel got the job to build up the Shuichang iron mine which supplies the present steelmaking facilities. Wuhan Steelworks, which has gotten help from the Federal Republic of Germany and Japan in the past, is planning to expand further. Foreign companies, particularly the Japanese, have been actively seeking to help construct various other steelworks.

In nonferrous metals, Fluor Corp. was awarded a contract to build a very large copper mine plant in Jiangxi Province on a cost-plus basis. When the 250,000-ton-per-year copper mine (which may be scaled down 20%) is finished, additional smelting capacity will be required; as of early 1979, Sumitomo Metal Mining had been awarded a contract to build a 90,000-ton-per-year copper smelter in Jiangxi. Nippon Light Metals will soon start on construction of an 80,000-ton-per-year aluminum reduction plant in Guizhou Province, and the Aluminum Company of America (ALCOA) was asked to submit bids on two other aluminum plants. Reynolds Aluminum and Kaiser Aluminum have also been invited to submit bids on developing additional deposits and facilities. The Chinese have requested Japan's Mitsubishi Metal Corp. to assist in the development of the lead-zinc industries as a whole; negotiations were also in progress with Toho Zinc to build a 100,000-ton-per-year zinc refinery. Metallgesellschaft AG and Lurgi have a long-term contract to help develop the nonferrous metals industries, including work on 22 plants around the country. French firms may help to assess tungsten resources.

In nonmetallics and energy, the Chinese sent inquiries to four Japanese firms about building at least one new cement work, with Kawasaki Heavy Industries having the best chance; also, Nippon Cement Co. won a contract to help modernize existing cement plants with suspension preheaters. A U.S. mining design company apparently is helping China to develop a major pyrite project near the Samsui oilfield in Guangdong Province. A large phosphoric acid plant has been bought from the United States, and U.S. phosphate experts have been asked to visit China, portending cooperative efforts in the future. The Chinese were seeking help from the Japanese in solar and geothermal energy, as well as hydropower and energy research. French firms were scheduled to sell U.S.-designed nuclear powerplants to China.

In late 1979, China's electric power capacity registered more than 50 million kilowatts (roughly one-eighth of that of the United States), and power output in 1978 was reported at 257 billion kilowatt-hours. A major thrust is being made to build up this vital industry, both large and small plants. The Chinese probably were thinking in terms of topping well over 100 million kilowatts by the mid-1980's. In 1979, hydropower accounted for approximately one-third of total electric power capacity and closer to one-fourth in terms of power generation, because of the intermittent nature of power from water resources. Hydropower was scheduled to be pushed, which is understandable since China's water resources may be the largest in the world. Three-fourths of the thermal electric power was derived from coal, and the rest mainly from oil and gas. Some of the large thermal plants completed recently include the ones within the properties of the Huainan and Huaipei coal combines in Anhui and the Tzupo coal combine in Shandong. China has extensive resources of all kinds of energy substances so that an enlightened program of development should make available adequate fuels and power for the country's industrialization needs. Coal will receive particular emphasis as a fuel in thermal power generation, but more natural gas will be utilized also. China at first decided to build nuclear powerplants quickly, but this program has been shelved indefinitely.

In the spring of 1978, China announced its initial program of developing basic industries during the next 8 years, along with other targets of the economy. The originally stated goal was to build or complete 120 large-scale projects, including 10 iron and steel complexes, 9 nonferrous metal complexes, 8 coal mining bases, 10 "Tachings" or oil and gasfields, 30 power stations, 6 new trunk railways, and 5 key harbors. The completion of these new projects, added to the existing facilities, was expected to provide China with 14 fairly strong and rationally located industrial bases that could be decisive in changing the backward nature of basic industries.

In March 1979, an editorial in the People's Daily (Renmin Ribao or Jen-Min Jih-Pao) called for reordering priorities in China's modernization program in favor of agricultural development and growth of light industry rather than of heavy industry. Some projects were to be scrapped or slowed down while proposals for new projects were to be strictly limited to avoid overextending the country's financial resources. Development of the steel industry was originally planned to be one of the cornerstones of the modernization program. However, the People's Daily indicated that the plans to double the 1978 production level by 1985 were overly ambitious. To this view, development of iron mines, new steel plants, and expansion projects could be affected and very likely delayed.

Nonetheless, a special effort will be made in the development of the power, fuel, and materials industries, along with transport and communications. In particular, the work in geological surveying, mine development, and construction will be stressed. Agriculture is, of course, also fundamental, and as much mechanization as possible will be introduced, along with the application and development of fertilizers. Agricultural products will be coordinated with petrochemically produced raw materials to meet the needs of light industry. The machine building industry will be coordinated and made more diversified, and the defense industries will be built up to serve both military and civilian purposes. Foreign trade will be expanded, both in terms of volume and types of industrial, mineral, agricultural, and other products, and in terms of purchasing raw materials, expertise and services, and industrial plants.

A few specific 1985 targets were announced, and some others might be surmised. China's original goal was to produce 60 million metric tons per year of steel by 1985, nearly twice the 1978 Chinese level and roughly half the U.S. output; most new capacity will come from plants to be built or expanded with foreign help. The steel target was subsequently revised downward to 45 to 50 million tons. The target for coal was approximately 800 to 900 million tons per year or one and a half times the 1977 level. (Chinese coal output is of the same magnitude as the United States.) The Chinese seem to be assured of 150 million tons per year of oil by 1985 - one-third of U.S. output - and could reach 200 million tons per year by 1990, depending on when new major fields come onstream. Cement production was well on its way towards reaching 85 to 90 million tons per year by 1985, surpassing what is presently produced in either the United States or Japan. The Chinese no doubt expect to more than double production of chemical fertilizers between 1977 and 1985, with many ultramodern plants to be placed in full-scale operation.

During the next 6 or 7 years, China hopes to bring up nonferrous base metal production from fairly low levels to medium-high by world standards. An effort will be made to produce larger quantities of the so-called export metals, as well as supply growing domestic needs. The small- and medium-enterprise sector, which is very important in China, will be built up accordingly. Expansion programs in power and transport, which are basic to development of natural resources, are also rather ambitious. The many projects underway or being planned indicate that most targets will eventually be achieved, perhaps up to 5 years behind schedule. In evaluating Chinese performance, it should be remembered that figures must be discounted somewhat to allow for quality problems and the small mine-plant sector.

PRODUCTION

Industrial production value in 1979 was 8% more than that in 1978, which, in turn, showed an increase of 13.5% over the 1977 value. There were many reports on production increases by individual enterprises, and China's State Statistical Bureau came out for the first time with 1977 and 1978 national output figures for many major industrial products showing the same upward trend. Corresponding data for 1979 are not yet available, although output of some major products were mentioned in the press. For 1978, production of 47 of the 80 major industrial products met targets at least 1 month ahead of schedule, including steel, pig iron, rolled steel, copper, coal, cement, and chemical fertilizers. Also production of nearly all 80 industrial products had increased considerably, with more than 50 products increasing in excess of 20% over the 1977 levels.

Coal production in 1978 was 12.4% more than that given for 1977, and crude oil production, 11.1% more. In contrast, gains in coal and oil in 1979 (over 1978) were only 1.6% and 1.9%, respectively. Efforts to improve efficiency and catch up on development were reasons for slower growth. Electric power production was 14.8% more than the 223 billion kilowatt-hours given for 1977. The performance of the steel industry in 1978 and 1979 was outstanding, with ingot and rolled steel outputs rising roughly 50% each in 2 years. In this instance, most idle steel capacity became more fully utilized. Cement production increased perhaps 10% and reportedly 17.5% in 1979 and 1978, respectively, over the previous years, with small-scale cement plants spearheading the way. In 1978, China was said to have produced 6.6 million tons of sulfuric acid, 1.33 million tons of soda ash, and 1.64 million tons of caustic soda. One major surprise in the reported output figures is salt, which was given as 17.1 million tons in 1977 and 19.5 million tons in 1978 - considerably lower than what western observers had thought. However, the salt figures very likely are incomplete and exclude the salts converted to industrial chemicals.

Production of other minerals and metals must be estimated because official data are not released. Natural gas output may be in the range of up to 100 billion cubic meters per year. Since the bulk of the pig iron is produced from iron ore, China's iron ore production of equivalent 50% Fe or better grade is rather high compared with other countries. China produces mostly direct-shipping iron ore, concentrates, and sintered ore rather than pellets. The Chinese report combined production of more than 1 million tons of copper, tungsten, tin, aluminum, lead, zinc, and two other nonferrous metals in 1979, or 12.8% more than in 1978.[4] This means mainly the combined output of the nonferrous base metals (refined)—copper, lead, zinc, and aluminum—since the others are no doubt small in quantity. China's production of the major nonferrous base metals is not significant by world standards. However, in basic materials, China is indeed important, ranking second in salt, third in coal, fourth in cement, fifth in steel, and within the first 10 in oil. China is one of the world's foremost producers of pyrite, and a medium large producer of phosphates. The country leads the world in tungsten, among the top three producers of antimony, and ranks closer to fifth in tin. Resources of these and other export metals look better as the years go by.

Table 1.—China: Estimated[1] production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978[p]	1979[p]
METALS				
Aluminum:				
Bauxite, gross weight[3]	[r]1,000,000	1,200,000	1,400,000	1,500,000
Alumina, gross weight	[r]400,000	[r]500,000	600,000	650,000
Metal, refined, primary	200,000	250,000	300,000	330,000
Antimony, mine output, metal content	12,000	12,000	13,000	15,000
Bismuth, mine output, metal content	[r]150	[r]150	300	350
Cadmium metal, smelter	[r]100	[r]100	120	120
Copper:				
Mine output, metal content	100,000	100,000	150,000	150,000
Metal:				
Smelter, primary and secondary	100,000	100,000	150,000	150,000
Refined, primary and secondary	150,000	150,000	200,000	200,000
Gold, mine output, metal content troy ounces	[r]80,000	[r]100,000	150,000	200,000
Iron and steel:				
Iron ore, gross weight[4] thousand tons	[r]45,000	50,000	70,000	75,000
Pig iron do.	[r]22,000	[5]25,050	[5]34,790	[5]36,700
Ferroalloys, blast furnace and electric furnace:				
Ferromanganese do.	190	230	310	340
Ferrosilicon do.	100	110	150	160
Silicon metal do.	5	5	8	10
Ferrochromium do.	60	70	90	90
Other do.	25	35	42	50
Total do.	380	450	600	650

See footnotes at end of table.

Table 1.—China: Estimated[1] production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978[p]	1979[p]
METALS —Continued				
Iron and steel —Continued				
Crude steel thousand tons	[r]20,000	[5]23,740	[5]31,780	[5]34,430
Rolled steel do	[r]14,000	16,330	[5]22,080	[5]24,760
Lead:				
Mine output, metal content	[r]90,000	100,000	120,000	120,000
Metal, refined, primary and secondary	100,000	[r]110,000	150,000	150,000
Magnesium metal, primary	1,000	NA	NA	NA
Manganese ore, gross weight thousand tons	1,000	1,000	1,300	1,500
Mercury, mine output, metal content 76-pound flasks	26,000	20,000	20,000	20,000
Molybdenum, mine output, metal content	1,500	1,500	2,000	2,000
Nickel:				
Mine	10,000	11,000	11,000	11,000
Smelter	9,000	10,000	10,000	10,000
Silver, mine output, metal content thousand troy ounces	[r]1,000	[r]1,000	1,500	2,000
Tin:				
Mine output, metal content	20,000	20,000	22,000	25,000
Metal, smelter	20,000	20,000	22,000	25,000
Tungsten, mine output, metal content	9,000	9,000	10,000	10,000
Zinc:				
Mine output, metal content	[r]100,000	100,000	120,000	120,000
Refined, primary and secondary	[r]100,000	100,000	120,000	120,000
NONMETALS				
Asbestos	150,000	200,000	250,000	250,000
Barite	300,000	350,000	400,000	500,000
Cement, hydraulic thousand tons	[r]40,000	[5]53,750	[5]65,225	[5]73,900
Fluorspar	350,000	400,000	400,000	400,000
Graphite	50,000	60,000	80,000	100,000
Gypsum	1,000,000	1,000,000	1,500,000	2,000,000
Kyanite	1,500	1,500	2,000	2,500
Lithium minerals, all types	9,000	10,000	10,000	10,000
Magnesite thousand tons	1,000	1,500	1,800	2,000
Nitrogen: N content of ammonia do	4,070	5,620	6,750	7,170
Phosphate rock and apatite do	4,000	4,000	4,500	5,000
Potash, marketable, K_2O equivalent[6] do	300	300	300	300
Pyrite, gross weight do	2,000	2,200	2,400	2,600
Salt[7] do	[r]20,000	[r]17,000	[5]19,537	20,000
Sodium compounds: Sodium carbonate, natural and synthetic do	NA	[5]1,089	[5]1,329	[5]1,783
Sulfur:				
Native	150,000	200,000	200,000	200,000
Content of pyrite	900,000	1,000,000	1,100,000	1,200,000
Byproduct, all sources	[r]300,000	300,000	350,000	400,000
Total	[r]1,350,000	1,500,000	1,650,000	1,800,000
Talc and related materials	150,000	150,000	150,000	150,000
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Anthracite thousand tons	20,000	25,000	30,000	35,000
Bituminous and lignite do	460,000	525,000	588,000	628,200
Total do	480,000	550,000	618,000	663,200
Coke, all types do	[r]22,000	[r]25,000	[5]32,374	[5]33,540
Gas, natural:				
Gross billion cubic feet	[r]385	[r]465	535	565
Marketed do	[r]350	[r]425	[5]485	[5]512
Petroleum:				
Crude (including crude from oil shale) thousand 42-gallon barrels	657,000	684,000	760,000	775,000
Refinery products do	548,000	650,000	600,000	620,000

[p] Preliminary. [r] Revised. NA Not available.

[1] Except those figures specifically footnoted as reported.

[2] In addition to the commodities listed for which quantitative estimates of output have been made, China is known or believed to have produced the following commodities for which no estimates, even of order of magnitude, have been prepared, owing to a paucity of general information upon which to base an estimate: Arsenic, chromite, titanium minerals, uranium, boron minerals, various clays (including kaolin), feldspar, lime, mica, sand, various industrial and dimension stones, and carbon black. Other unlisted commodities also may be produced.

[3] Diasporic bauxite; includes an estimated 163,000 metric tons per year of production for refractory applications.

[4] In terms of 50% Fe ore.

[5] Reported figure.

[6] Data are for years ending June 30 of that stated. Source: British Sulphur Corp. Ltd. Statistical Supplement No. 18, November-December 1978.

[7] Series revised to correlate with reported figure for 1978.

TRADE

China's exports and imports totaled 45,300 million yuan last year, 29.2% higher than in 1978, the Ministry of Foreign Trade reported. Exports, led by a strong increase in the sale of heavy industrial goods, totaled 21,200 million yuan, an increase of 26.6%. Imports totaled 24,100 million yuan, an increase of 31.6%. The rise in sale of heavy industrial goods over 1978 was 59%, which accounted for 32.1% of the total increase in exports. Items included petroleum, hardware, chemicals, minerals, machinery, and equipment. Export of light industrial goods increased by 23.2%, and agricultural and sideline produce rose 1.9%. Because of the rise in the sale of heavy industrial goods, however, the proportion of agricultural products to the total export value decreased. Among imports, new technologies and complete plants went up 190% over 1978, accounting for 14.7% of the total. Consumer goods rose 40%. Materials for agricultural use increased by 18.4%, and raw materials for light industry, 12.9%. Meanwhile, the Ministry reported, imports of rolled steel, aluminum, pig iron, and iron ore were reduced. To increase its foreign trade, China built export commodity centers, plants, and workshops and has tapped increasing numbers of resources for possible export. In 1979, the value of all industrial, agricultural, and other goods purchased for export ran to 29,600 million yuan, a rise of 32% over the previous year.[7]

With a headstart, Japan developed $5 billion worth of annual trade with China in a little over 5 years. Japan's two-way trade with China in 1978 reached $5.08 billion, with Japanese exports to China worth $3.05 billion and Japanese imports from China worth $2.03 billion. Machinery shipments to China trebled the 1977 level, and steel shipments in 1978 surpassed 5 million tons. To assure steel supplies needed for construction, Japanese steelmakers have signed a 3-year pact to furnish China with a total of 15 million tons. Chinese demand for seamless pipes for oil distribution is so strong that the country was considering investing in additional pipemaking facilities within Japan. Considerable quantities of Japanese fertilizers go to China, although their combined value is not great. China's most important single export item to Japan in 1978 continued to be petroleum, valued at roughly $900 million. Japanese exports to China rose 21.3% over 1978 despite a sharp drop in steel shipments, whereas Japanese imports from China increased 45.5%, mainly because of the spectacular growth in fuel prices.

China's trade with other countries was also on the rise. In early 1978, a general trade pact was signed with the European Community countries to expand trade and afford China favorable treatment. As a result, two-way trade with Western Europe increased at least $1 billion in 1979 over the $2.5 billion figure in 1978. The British and the Chinese agreed in principle to sharply boost bilateral trade from the current level of $400 million per year to $10 billion by 1985, and signed a nonferrous metals trading agreement on January 30, 1979, which related not only to marketing but possibly also to mineral development in the future.[8] China and France signed a 7-year trade agreement of almost $14 billion. The Federal Republic of Germany concentrated on trying to sell metal plants, chemical facilities, and coal mine development in substantial deals. Various industrial and trade agreements involve Great Britain, China, and Hong Kong. China may have earned as much as $2 billion from its exports to Hong Kong during 1978 and $2.4 billion in the first 10 months of 1979. Two-way U.S.-China trade was over $1.1 billion in 1978, and over $2 billion in 1979. This trade can further blossom under the right conditions, but developing specific exports to the United States may be difficult. So far, China has been paying for the technical services rendered by U.S. firms mainly by cash, but credits and payments in kind may come into play.

Table 2.—China: Apparent exports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977[2]	1978[3]	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite	59,719	86,522	Japan 31,785; Italy 28,470; West Germany 9,543.
Alumina	8,165	10,398	Finland 4,907; Hong Kong 2,380.
Metal including alloys, semimanufactures	580	1,324	Hong Kong 1,040; Sudan 218.

See footnotes at end of table.

Table 2.—China: Apparent exports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977[3]	1978[3]	Principal destinations, 1978
METALS —Continued			
Antimony:			
Ore and concentrate	[4]1,248	249	Spain 141; Japan 46; United States 37.
Metal and regulus	[4]1,133	4,793	United States 1,924; Japan 1,578; France 601.
Arsenic:			
Natural sulfides	25	10	All to Japan.
Trioxide	853	253	Japan 215.
Chromium:			
Chromite	NA	80	All to Thailand.[5]
Oxide and hydroxide	--	40	All to Singapore.[5]
Copper:			
Sulfate	[4]200	105	All to Japan.
Metal including alloys:			
Unwrought	--	455	Belgium-Luxembourg 350;[5] Thailand 100.
Semimanufactures	842	1,495	Hong Kong 1,096; Thailand 281.
Iron and steel:			
Ore and concentrate	--	38	All to United States.
Metal:			
Scrap	--	177	Japan 172.
Pig iron	3,228	6,475	Hong Kong 3,775; Singapore 2,700.
Ferroalloys	904	277	Sweden 177;[5] Yugoslavia 85.
Semimanufactures ---- thousand tons	63	187	Hong Kong 148; Singapore 14.
Lead:			
Ore and concentrate	--	1,500	All to Yugoslavia.
Oxide	125	403	Indonesia 135;[5] Hong Kong 95; Singapore 55.
Metal including alloys, semimanufactures	--	138	Egypt 128.
Magnesium metal, all forms	--	1	All to Ireland.[5]
Manganese:			
Ore and concentrate	52,117	[5]46,346	Japan 42,661; West Germany 2,357.
Oxide	251	1,609	Finland 1,020; Hong Kong 369.
Metal, all forms	--	25	All to Netherlands.
Mercury ---- 76-pound flasks	4,099	6,313	United States 3,328; Hong Kong 1,230.
Molybdenum ore and concentrate	--	60	All to Japan.
Nickel metal including alloys, semimanufactures	--	4	Sudan 3.
Silver, unworked or partly worked value, thousands	--	[5]$4	Canada $2; Switzerland $1.
Tin metal including alloys:			
Unwrought	2,878	5,060	Yugoslavia 1,779; United States 1,571; [6] Netherlands 738.
Semimanufactures	15	108	Hong Kong 95.
Titanium:			
Ore and concentrate	--	569	All to United States.
Oxides	1,402	1,225	Japan 415; Hong Kong 330; France 301.
Tungsten:			
Ore and concentrate	2,655	3,227	Austria 1,133;[5] West Germany 1,009.
Metal, all forms	12	7	All to Yugoslavia.
Zinc:			
Oxide	150	914	Hong Kong 369; Japan 289.
Metal including alloys:			
Unwrought	4,508	9,120	Thailand 2,954; Hong Kong 2,941; Japan 1,990.
Semimanufactures	--	28	Hong Kong 26.
Zirconium ore and concentrate	9	10	All to Japan.
Other:			
Ores and concentrates	2,327	2,455	Egypt 1,000; Thailand 620; Singapore 296.
Ash and residue, nonferrous	302	427	Hong Kong 400.
Oxides, hydroxides, peroxides	216	295	Japan 80; Hong Kong 70.
Metals:			
Metalloids	15	16	Kenya 8; Denmark 5.
Base metals, including alloys all forms, n.e.s	2,916	1,724	Singapore 263; Japan 260; Hong Kong 234; West Germany 231.[5]
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum	445	325	All to Japan.
Grinding and polishing stones	317	662	Hong Kong 458; Indonesia 188.[5]
Asbestos	3,671	6,026	Indonesia 2,440;[5] Thailand 1,199; Japan 940.
Barite and witherite	27,837	106,157	West Germany 61,577; Netherlands 24,331; Japan 16,966.
Boron oxide and acid	395	141	Japan 107.
Cement ---- thousand tons	418	718	Hong Kong 716.
Chalk	--	30	All to Singapore.

See footnotes at end of table.

Table 2.—China: Apparent exports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977[2]	1978[3]	Principal destinations, 1978
NONMETALS —Continued			
Clays and clay products:			
Crude	68,615	84,484	Japan 59,522; Italy 8,684;[5] Hong Kong 6,010.[5]
Products:			
Refractory	NA	6,210	Singapore 3,988; Indonesia 1,921.[5]
Nonrefractory	21,973	23,544	Hong Kong 19,728.
Cryolite and chiolite, natural	200	433	All to United States.
Diamond:			
Gem, not set or strung value, thousands	$972	[5]$2,002	Japan $1,242; Hong Kong $311; Belgium-Luxembourg $227.
Industrial do	$1,105	[5]$1,035	All to Belgium-Luxembourg.
Diatomite and other infusorial earth	--	11	All to Sweden.[5]
Feldspar and fluorspar	141,639	170,383	Japan 155,770.
Fertilizer materials:			
Crude:			
Nitrogenous	NA	[5]480	Belgium-Luxembourg 240; Indonesia 240.
Phosphatic	NA	115	All to Singapore.
Manufactured, including mixed	33	10	All to Hong Kong.
Ammonia	--	12	Indonesia 10.[5]
Graphite, natural	13,335	12,237	West Germany 3,968; United States 2,763; Japan 1,933.
Gypsum and plasters	1,710	3,420	Hong Kong 1,763; Indonesia 885;[5] Singapore 682.
Lime	41,618	29,148	Hong Kong 28,979.
Magnesite	47,290	59,893	Japan 21,116; West Germany 13,918.
Mica, all forms	4,172	5,597	United Kingdom 4,112; West Germany 900.
Pigments, mineral:			
Natural, crude	1,103	2,661	Japan 1,098; Hungary 628; Indonesia 585.[5]
Iron oxides, processed	423	2,599	Indonesia 579;[5] Singapore 539; Hong Kong 483.
Precious and semiprecious stones value, thousands	$2,554	$5,795	Hong Kong $2,999;[5] United States $1,135; Japan $1,120.[5]
Salt	24,727	165,286	Japan 137,610; Hong Kong 27,592.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	5,145	15,656	Hong Kong 9,653; Egypt 5,137.
Caustic potash	NA	18	All to Indonesia.[5]
Soda ash	2,126	4,100	Hong Kong 3,069; Indonesia 563.[5]
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	19,457	35,586	Japan 32,999.
Worked	5,758	18,115	Hong Kong 8,005; Singapore 3,145; Indonesia 3,075.[5]
Gravel and crushed rock	18,594	58,159	Hong Kong 53,769.
Limestone	6,328	23,353	All to Hong Kong.
Quartz and quartzite	13,279	25,666	Japan 15,471; Hong Kong 10,142.[5]
Sand	789,902	990,772	Hong Kong 990,771.
Sulfur:			
Elemental	NA	28	Singapore 25.
Sulfuric acid	47	99	All to Hong Kong.
Talc	209,218	291,580	Japan 246,639; United Kingdom 8,744.
Other:			
Crude	7,960	10,114	Hong Kong 5,850; Japan 1,195.
Slag, dross, other waste	4,100	22,846	Japan 21,600.
Oxides of magnesium, strontium, barium	2,307	165	Finland 120.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	[4]1	155	All to Thailand.
Coal:			
Anthracite and bituminous coal thousand tons	494	797	Japan 772.
Briquets of anthracite and bituminous coal do	141	NA	
Lignite and lignite briquets	100	1,219	All to Japan.
Petroleum:			
Crude thousand 42-gallon barrels	48,497	59,030	Japan 54,772; Thailand 3,395.
Refinery products:			
Gasoline do	40	[5]159	All to Hong Kong.
Kerosine and jet fuel do	1,557	[5]1,902	Do.
Distillate fuel oil do	14	[5]6,658	Hong Kong 6,088.
Residual fuel oil do	6	[5]1,672	Hong Kong 1,671.
Lubricants do	42	[5]75	Hong Kong 69.
Other:			
Mineral jelly and wax do	623	[5]166	Hong Kong 90; Thailand 34.
Nonlubricating oils do	NA	[5]31	Indonesia 30.
Petroleum coke do	789	[5]979	All to Japan.

See footnotes at end of table.

Table 2.—China: Apparent exports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977[2]	1978[3]	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	7,005	1,074	Japan 1,044

NA Not available.

[1] Owing to the lack of official trade data published by China, this table should not be taken as a complete presentation of China's mineral trade. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

[2] Unless otherwise specified, data are compiled from the 1977 edition of the World Trade Annual, prepared by the Statistical Office of the United Nations, Walker and Co., New York, 1979, as well as official trade statistics of Czechoslovakia, Hungary, Poland, and the U.S.S.R.

[3] Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[4] Official trade statistics of Japan.

[5] 1978 World Trade Annual, Statistical Office of the United Nations, Walker and Co., New York, 1980.

Metallgesellschaft AG. Metal Statistics 1968-78, 66th ed., Frankfurt am Main, 1979.

Table 3.—China: Apparent imports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977[2]	1978[3]	Principal sources, 1978
METALS			
Aluminum:			
Alumina	150	388	West Germany 367.
Metal including alloys:			
Unwrought	97,243	165,907	Canada 76,598; Norway 23,413; West Germany 13,278.
Semimanufactures	915	5,477	Japan 5,030; West Germany 321.
Chromium:			
Chromite	--	5,500	All from Turkey.[4]
Oxide and hydroxide	525	13	All from Japan.
Cobalt oxide and hydroxide kilograms	[5]25	2,025	Denmark 2,000.[4]
Copper:			
Ore and concentrate	--	13,399	All from Peru.[6]
Matte	--	15,300	All from Chile.[6]
Sulfate	--	4,395	All from Yugoslavia.
Metal including alloys:			
Scrap	NA	121	Hong Kong 102.
Unwrought	75,628	74,014	Peru 21,280;[7] Zambia 17,503;[6] West Germany 13,553.
Semimanufactures	72	311	Hong Kong 162; Japan 100.
Iron and steel:			
Ore and concentrate	1,405	5,998	Australia 5,534.[8]
Metal:			
Scrap	93	4,452	All from Hong Kong.
Pig iron thousand tons	844	947	Australia 534;[8] Brazil 232.[4]
Ferroalloys do	4	53	Japan 23; Portugal 12;[4] Spain 8.[4]
Steel, primary forms do	256	987	Japan 716; West Germany 160.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	1,010	[4]2,296	Japan 1,236; West Germany 203; Italy 175.
Plates and sheets do	2,152	[4]3,423	Japan 2,662; West Germany 285.
Hoop and strip do	179	[4]246	Japan 150; West Germany 49.
Rails and accessories do	55	48	All from Japan.
Wire do	9	[4]39	West Germany 12; Belgium-Luxembourg 6; Japan 5.
Tubes, pipes, fittings do	869	[4]1,241	Japan 566; West Germany 515.
Unspecified do	144	--	
Lead:			
Oxide	[5]40	108	All from Belgium-Luxembourg.[4]
Metal including alloys:			
Unwrought	10,499	23,983	Australia 9,496;[7] Peru 8,496;[7] Canada 3,681.
Semimanufactures	--	1	All from Japan.
Magnesium metal, all forms	10	999	All from United States.
Manganese oxide	1,267	826	All from Japan.
Molybdenum metal, all forms	[5]3	5	Do.
Nickel:			
Matte and speiss	--	115	All from Canada.[4]
Metal:			
Unwrought	10	--	
Semimanufactures	45	100	Japan 61; West Germany 28.

See footnotes at end of table.

Table 3.—China: Apparent imports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977[2]	1978[3]	Principal sources, 1978
METALS —Continued			
Platinum-group metals, unworked or partly worked value, thousands	$2,058	[4]$4,366	United Kingdom $2,783; West Germany $864.
Silver, unworked or partly worked do	--	[4]$49	United Kingdom $45.
Tantalum metal, all forms	[5]2	1	All from Japan.
Tin metal, unwrought	--	2	All from Singapore.
Titanium oxide	1,246	1,219	Japan 960; Belgium-Luxembourg 118.[4]
Tungsten metal, all forms	7	13	All from Japan.
Zinc:			
Oxide	238	78	United Kingdom 76.[4]
Metal including alloys:			
Unwrought	5,056	5,158	Peru 3,999;[7] Canada 1,159.
Semimanufactures	2	8	All from Italy.[4]
Other:			
Oxides, hydroxides, peroxides	108	67	United Kingdom 25;[4] Japan 21.
Metals:			
Metalloids	1,701	5,118	France 3,181;[4] United Kingdom 1,627.[4]
Base metals including alloys, all forms, n.e.s	1	1	All from United Kingdom.[4]
NONMETALS			
Abrasives: Grinding and polishing stones	12	71	West Germany 30;[4] Italy 18;[4] Japan 16.
Asbestos	74	296	All from Canada.
Boron oxide and acid	--	272	All from Italy.[4]
Cement thousand tons	--	167	All from Japan.
Clay products:			
Refractory	3,888	[4]1,461	Japan 693; West Germany 513.
Nonrefractory	40	[4]679	Italy 659.
Diamond:			
Gem, not set or strung value, thousands	$745	[4]$4,158	All from United Kingdom.
Industrial do	$1,331	[4]$4,253	Belgium-Luxembourg $3,867.
Diatomite and other infusorial earth	--	282	Japan 272.
Feldspar and fluorspar	NA	72	All from Kenya.
Fertilizer materials:			
Crude, nitrogenous thousand tons	NA	[4]245	Morocco 203.
Manufactured:			
Nitrogenous do	1,879	1,662	Japan 1,215; Italy 191; France 113.
Phosphatic do	NA	129	Morocco 97.[4]
Potassic do	50	207	United States 125; West Germany 50.[4]
Other, including mixed do	177	244	Italy 69; Belgium-Luxembourg 69; West Germany 64.[4]
Gypsum and plasters	8,965	18	All from United Kingdom.
Magnesite	--	91	Yugoslavia 88.
Precious and semiprecious stones value, thousands	$536	[4]$340	West Germany $254; Austria $47.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	41,244	57,932	Italy 19,418; Spain 17,060; West Germany 11,502.
Soda ash	NA	28,250	All from Kenya.
Stone, dimension	90	620	All from Italy.[4]
Sulfur:			
Elemental	254,222	205,235	All from Canada.
Sulfuric acid	--	3	All from France.[4]
Other:			
Crude	--	3	All from United Kingdom.[4]
Slag, dross, other waste	--	7	All from Singapore.
Oxides of magnesium, strontium, barium	--	52	All from Japan.
Halogens	40	53	Italy 25;[4] Japan 22.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	7,114	17,153	Japan 17,152.
Coal, anthracite and bituminous thousand tons	--	24	All from United States.
Petroleum refinery products thousand 42-gallon barrels	28	42	Yugoslavia 16; Italy 11; West Germany 4.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	20,956	24,214	West Germany 22,433.[4]

NA Not available.

[1] Owing to the lack of official trade data published by China, this table should not be taken as a complete presentation of China's mineral trade. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

[2] Unless otherwise specified, data are compiled from the 1977 edition of the World Trade Annual, prepared by the Statistical Office of the United Nations, Walker and Co., New York, 1979, as well as official trade statistics of Czechoslovakia, Hungary, Poland, and the U.S.S.R.

[3] Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[4] 1978 World Trade Annual, Statistical Office of the United Nations, Walker and Co., New York, 1980.

[5] Official trade statistics of Japan.

[6] World Metal Statistics, World Bureau of Metal Statistics, London, 1979.

[7] Metallgesellschaft AG. Metal Statistics 1968-78, 66th ed., Frankfurt am Main, 1979.

[8] Australian Mineral Industry Quarterly, Australian Government Publishing Service, Canberra, 1979.

COMMODITY REVIEW

METALS

Aluminum.—China's aluminum consumption has clearly risen to 400,000 to 500,000 tons per year, with two-thirds derived from domestic output and the rest from imports. Because China is far behind world levels in aluminum use, serious efforts are being made to build new plants, acquire foreign knowhow, and develop indigenous resources. Meanwhile, large-scale imports probably will be continued (maximum of more than 300,000 tons per year in 1975), mainly in the form of metal or alumina rather that bauxite. Since production of aluminum by the Hall Process requires 15,000 to 20,000 kilowatt-hours of electricity per ton, cheap and dependable power is a prerequisite, commonly either hydropower or power from natural gas. There should be little difficulty with the local supply of chemicals, although more chemicals are required to digest Chinese aluminum raw materials.

The first specific new foreign aluminum project is a $260 million, 169,000-ampere, 80,000-ton-per-year prebaking type of reduction plant, to be built at Guiyang, Guizhou Province, by Nippon Light Metal Co., an affiliate of Canada's ALCAN. The contract, signed January 7, 1979, stipulates startup by March 1981 and full-scale operation within a year thereafter.[9] Anticipating this development, Nippon had trained nine Chinese engineers at its Niigata plant during the previous summer. Serious talks had also been made with Sumitomo Aluminium and Showa Denko, suggesting that obtaining Japanese help in constructing another plant of this size is possible.

ALCOA has talked with the Chinese on several occasions about developing the aluminum industry. In late January 1979, a letter of intent was signed with ALCOA to conduct feasibility studies for the construction of two very large integrated aluminum plants in China. Kaiser Aluminum and Reynolds Aluminum were asked to visit China in early 1979. Alsar-Alumetal SpA of Italy may supply China with aluminum and technology, and Pechiney and Alusuisse have maintained contact with the Chinese throughout recent years. Overall, the Chinese probably are planning to develop about 1 million tons per year of capacity in a decade; most of this must be built with foreign help. The first major project may be located in southern Guangxi, to utilize local ores.

The only sizable aluminum reduction plant known to be in existence in China is Fushun in the northeast, rated at about 100,000 tons per year. This plant has horizontal stud Soderberg cells of 450 kilograms per day, erected in two workshops, each with two potlines of 160 cells apiece. Nating in Changtien, Shandong, with four big rotary kilns houses China's largest alumina plant. There is a sizable alumina—aluminum complex, in Zhengzhou, Henan. The Shanmen Gorge plant on the Henan-Shanxi border and the Yiliang plant located 80 kilometers southeast of Kunming have two potlines each and may be up to 30,000 tons per year in capacity. Other plausible plant locations are Lanzhou in Gansu, Taiyuan in Shanxi, Wuhan in Hubeh, Changling in Julin, Qingtas in Shandong, Chengdu in Sichuan, Hefei in Anhui, and Baotou in Inner Mongolia, all of which are probably rather small aluminum plants.

China seems to have extensive resources of aluminum raw materials, which a Hungarian authority estimates at possibly 1.2 billions tons.[10] Thus, workable reserves could amount to a few hundred million tons. An Australian geologist, Ikonikov, makes the following five generalizations on Chinese bauxites: All known deposits are of platform origin; deposits are mainly carboniferous and secondarily Permian; diaspore is the main ore mineral; Chinese bauxites contain recoverable gallium, germanium, and sometimes uranium; and the aluminum materials, while low in iron, are high in silica, requiring more chemicals to clean. China also has several types of alunite and aluminous shales. Much recent exploration has been done with good results.

A large, high-grade bauxite deposit has been reported in Pingguo County in Guangxi Province and is capable of supporting a major aluminum center.[11] Exploration in Pingguo began in 1972; to date, 4,500 shallow pits have been dug and 34,000 meters of tunneling have been driven. The very high grade (59.9% Al_2O_3), secondary type of bedded ore occurs very near the surface along the banks of the Yujiang River. At least one U.S. aluminum company has been asked to evaluate this deposit, in terms of eventually building reduction facilities to utilize the ores.

Antimony.—Along with the Republic of South Africa and Bolivia, China is one of the big three world producers of antimony. However, the 10,000 to 13,000 tons of antimony produced annually by China (one-half exported) does not provide too much foreign exchange because of the limited tonnages and moderate prices. In January 1979, the price of antimony was only about $1.30 per pound, and the Chinese were trying to hold back for better prices. In the last few years, more metal has been exported at the expense of concentrates. Japan, traditionally a large buyer, imported 1,133 tons of metal in 1977 and 640 tons in the first half of 1978, but only a trickle of Chinese antimony ore for 1978 overall. Antimony reserves have long been acknowledged as very large by world standards, and production could be raised as needed in China's modernization program. How much China is to export is purely a policy decision. Hsikwangshan or Xikuangshan and nearby areas in southwestern Hunan Province have long been China's main antimony-producing districts. Guangdong Province ranks a distant second in potential and output. Antimony technology is well advanced in China, from mining and beneficiation to making metal, oxides, and sulfides. The three leading world producers last met in La Paz, Bolivia, in 1975.

Cobalt.—Cobalt in China has been mentioned in three connections recently. The nickel sulfide deposit (see "Nickel" section) may have a cobalt reserve of more than 100,000 tons or 2% of the known nickel reserves. However, because of the low grade, perhaps only half of this is recoverable. The Jinchuan nickel mine in Gansu, which can be greatly expanded in the future, possibly furnishes 100 tons of contained cobalt annually at present. A large complex metal deposit in Southwest Yunnan Province, within the Dahungshan District, has cobalt in the ores, along with copper, iron, and precious metals. A 1-billion-ton titaniferous magnetite deposit in Szechuan has cobalt in the ores, along with vanadium, nickel, chromium, and gallium. A cobalt deposit with copper values has been reports for Hainan Island. Thus, China may be moderately endowed with the strategic metal cobalt.

Copper.—China has the capacity to produce about 300,000 tons per year of refined copper, and it imports 150,000 to 200,000 tons per year of copper in all forms. In early December 1978, Sumitomo Metal Mining Co. was awarded a $117 million contract to build an integrated copper smelter (probably Flash smelter) in Guixi, Jiangxi Province, southern China, rated at 90,000 tons per year of refined copper plus 360,000 tons per year of sulfuric acid.[13] China has only two nonferrous smelters (with important copper units——about 50,000-ton-per-year size) that might be classified as medium in size by world standards, Shanghai and Shenyang in Liaoning. There are no large ones. Kunming in Yunnan, Paiyin in Gansu, Tongling in Anhui, and Dayeh in Hubei have 30,000- to 40,000-ton-per-year copper smelters or refineries. Small copper facilities have also been mentioned for Lanshou, Urumchi, Taiyuan, Peking, and Hainan Island. Late in 1978, two West German firms, Metallgesellschaft AG and Lurgi Gesellschaft, were awarded a contract to supply 22 plants for China's nonferrous metals industry.

China seems to have adequate copper resources for meeting its expanding industrial needs, although production is small at the moment. A recent Fluor Corp. contract revealed that an extensive porphyry deposit exists in Jianxi Province capable of supporting an open pit operation with a daily output of 175,000 tons of 0.5% copper ore. In fact, a multimillion dollar, 4-stage contract signed with this U.S. firm initially called for building a roughly 250,000-ton-per-year copper mine plant near Tien Pan Chieh, in the Tehsing (Dexing) area, scheduled for completion by 1983. Such a project would be bigger than any single one in Chile in terms of ore output. However, the project was subsequently scaled down about 20% and moved back roughly 2 years. Tehsing copper ores have good values in molybdenum, precious metals, and rhenium. Reserves so far determined amount to about 8 million tons of contained copper. There are already three mines in Tehsing, namely Tungchang, Fuchiawu, and Chuhahung.

The British have reported that three substantial copper porphyry ore bodies at Yuanqu, Shansi Province, will be developed or expanded; one of these is already worked fairly efficiently, yielding 4,000 tons per day of ore. Chinese news releases in mid-February 1979 mention that a large porphyry copper deposit had been found in Qamdo Prefecture, eastern Tibet, with more than 7 million tons of copper reserves close to the surface. A large ultramafic nickel-copper sulfide deposit, in part minable by open cut methods, has been reported in Jinchuan in western Gansu (see below under "Nickel");

in fact, a medium-size mine is already in operation.

China also has extensive and high-grade skarn copper deposits in the middle and lower regions of the Yangtze River and many other areas. Its better known copper mines include Hungdoushan, north of Fuschun, Huadong at Chingyuan, Tunghua in Jilin, and Tungguanshan in Anhui. None are large. For example, Hungdoushan which produces 2,000 to 3,000 tons per day of ore containing 1.5% copper and 1% zinc. The medium-size Tungchuan underground copper mine in Yunnan Province has been rejuvenated. A large copper-iron deposit with cobalt and precious metal values was discovered recently in the Dahungshan area of Yunnan. The March 1978 issue of China Pictorial showed a photograph of another medium-size copper mine, in the Fenghuang Hills of Tung-ling Hsien, Anhui Province. A copper mine near Dayeh (Tayeh), Hubei, was producing about 3,000 tons of 1% copper ore per day.

While carrying out the program to acquire foreign smelters and develop domestic mines, China was also continuing its efforts to import whatever copper is necessary. An agreement was signed with Chile in October 1978 to supply China with 30,000 tons per year of copper over 3 years. For helping develop the Tintaya mine in Peru, China was scheduled to be repaid with about 40,000 tons of copper annually plus 10,000 tons each of lead and zinc. Although the Chinese were hoping to get steady if not expanded supplies of copper (up to 50,000 tons per year) from Africa through construction of the 1,100-mile Tanzam Railway, political instability there may work against this. A 3-year contract was signed with Papua's Bougainville management in March 1978 to supply China with 20,000 to 22,000 tons of copper concentrates annually. A contract with the Philippines, agreed upon in November 1978, called for 60,000 tons per year of concentrates, basically to be bartered for Chinese oil on a long-term basis. China received about 32,000 tons of the Philippines copper concentrates in 1976 and 67,000 tons in 1977. China has had a commercial problem with Philippine copper concentrates containing high gold values, and the Philippines will have difficulty supplying China unless new mines are developed.

Gold and Silver.—China has never been important as a gold or silver producer, although the potential might be there, especially under high-price conditions. However, there have been great accumulations of both metals since time immemorial from local ores and placers plus imports of metals. The gold picture is brighter, as many rivers in Heilongjiang, Jilin, and Sichuan already together yield 100,000 to 200,000 ounces of placer gold per year. Sinkiang or Xinjiang seems to have both placers and lode mines. In fact, gold activity has been reported in widely scattered areas of the country, including Hunan, Guangxi, Henan, Shandong, and Zhejiang. If enough large copper mines are eventually developed, byproduct gold should be of consequence too. When China was on the silver standard, much silver was imported from Mexico in the early part of the 20th century. This supply and what was previously in circulation formed the basis of silver exports to European markets in the 1950's. China's silver output could become significant if more nonferrous mines are developed in the future.

One of China's major sources of gold is the Zhaoye mine, located in the northwestern part of Jiaodong Peninsula in Shandong Province.[13] This ancient lode mine, with copper sulfide ores and high gold-silver values, is producing about 500 tons of ore per day. There are three large mills and a number of small mills. A recent survey has added about 250 tons of gold reserves to what had previously been known at Zhaoye, and more exploration work is taking place. Actually, there are additional gold deposits nearby, all located within Zhaoyuan and Yexlian Counties.

Heilongjiang's Heiho gold mining bureau has various gold mines—Kuntachi, Fandaging, Liumaoho, and Hantashihchung—mainly in the Aihui, Huanan, and Wulaga areas. A large gold-silver deposit reportedly has been found somewhere in Zhejiang Province. China's foremost silver mine is located in Wesihangcheng, Henan Province.[14] The Tehsing copper deposit apparently has fair amounts of gold and silver. Liaoning, Jiangxi (Yinshan mine), and Hebei have small lode gold mines. China recently ordered three 300-liter bucket dredges from the Mining and Transport Engineering BV of Amsterdam for use in northern China at a maximum dredging depth of 35 feet. The Chinese were also making inquiries of a U.S. bank for credits to finance gold operations.

Iron and Steel.—The Chinese were jubilant about their 1978 and 1979 steel production, claiming various national records after successfully combating the problem of the "gang of four" and more fully utilizing existing capacity. Steel production was in the neighborhood of 35 million tons per year at yearend 1979. According to Chairman Hua in early 1978, China's 1985 target for steel output was 60 million tons; however, this was subsequently scaled down to 45 to 50 million tons. By 1985, small and medium enterprises might account for an increment of 5 million tons per year or so; the rest of the expected gain will come from major steelworks existing or new.

With regard to new steelworks, construction of Baoshan (Paoshan) Steelworks in the Shanghai area had already started by late 1978. Baoshan is expected to have 6 million tons per year of steel capacity around 1985 and as much as 10 million tons per year eventually. A second large coastal steelworks called Chitung (Jidong) may not get off the ground until after 1985, and plans could be shelved again. As for existing steelworks, top priority will go to Anshan, in Liaoning Province, whose capacity would be roughly doubled eventually to approximately 15 million tons; basically, the expansion effort would involve building a new steelworks while modernizing the existing one. Depending upon the availability of funds and foreign exchange, long-range plans include the expansion of four other major steelworks from the present capacity of 1 to 3 million tons per year each to possibly 4 to 6 million tons per year; the four operations are Peking (Shoutu, Capital, or Beijing), Taiyuan in Shanxi Province, Wuhan in Hubei Province, and Benxi (Penchi) in Liaoning Province near Anshan.

China also intends to upgrade its special steel facilities. In January 1979, Japan's leading special steelmanufacture, Daido Steel Co., was contracted to help modernize and expand four existing special steel plants, Fushun, Luda, Dayeh, and Tientsin. The first three are presently rated at 300,000 to 500,000 tons per year, and their capacities will be doubled. Tientsin will be converted from an ordinary to a special steel plant. Daido Steel was also trying to get the contract to modernize the Peking Steelworks and its special steel plant.

China's mounting steel needs not only necessitate plant expansion but continued large imports as well. Japan has been China's leading steel supplier by far during recent years, furnishing 2.8 million tons of steel products in 1975, 3.5 million tons in 1976, 4.5 million tons in 1977, 5.6 millions tons (worth roughly $1.5 billion) in 1978, and 4.5 milllion tons in 1979. China was Japan's second largest steel customer in 1978 and 1979, not far behind the United States. The Federal Republic of Germany ranked a distant second to Japan as a steel supplier to China, and a dozen other countries each furnished 20,000 to 70,000 tons annually. Although building up steel capacity aims at reducing imports, cutbacks in imports are hardly likely in the next few years, in view of the very large steel requirements for basic construction. The Chinese were negotiating a 3-year trade pact with Japanese steel companies in February 1979 to obtain 15 million tons of steel products between the mid-1979 to mid-1982.

China's changing steel economy means that the iron ore base must likewise be expanded, whether domestic or foreign. Based upon the reported pig iron production, output of iron concentrate or high-grade ore of equivalent 60% iron grade can be estimated at more than 70 million tons per year. The Anshan Steelworks was making important progress in mining its "Mesabi" type of ores, with regard to both extraction tonnage and metal recovery. Knowledgeable Chinese have already visited the United States several times, and various U.S. firms and consultants have been invited to China. In the fall of 1978, Kaiser Engineers, Inc., was awarded a contract to expand Benxi's Nanfen low-grade iron mine near Anshan and develop the Szechiaying iron mine in eastern Hebei Province near Luanhsien, which appears to be in the heart of China's second "Mesabi Range."

In early December, Bethlehem Steel signed a contract to expand and modernize the Suichang iron mine. In early 1979, United States Steel Corp. successfully negotiated with China to build a mine plant in northeast China capable of producing 17 million tons per year of pellets (see below), and was subsequently asked to bid on building steelmaking facilities. During mid-January 1979, the U.S. firm, Midland Ross Corp., discussed the possible sale of direct-reduction steel furnaces to China; this process requires high-grade iron ore and often natural gas. There is also a plan to locate and develop at least 10 medium-size, high-grade iron deposits in the next decade. Reported new discoveries of such deposits with reserves of 100 million tons or more include Okou in Shanxi Province, a deposit (perhaps in Chienxi) in southern Hebei Province, a deposit in Sichuan near the Jinsha River, and two deposits in Yunnan Province, one in northern Yunnan and one in the northern part of the Hengduan Mountains.[18] A half-billion-ton iron deposit was very recently discovered in the Jiangyang region, Anhui Province.

The Chinese have already started a program to import high-grade iron to add to the low-grade domestic product and thereby improve smelting efficiency. Most such ores have come from Australia, which furnished about 1.5 million tons in 1976, 3 million tons in 1977, and over 5 million tons in 1978. Purchases from Australia in 1978 were over 6 million tons per year, including 2.4 million from Mount Newman and the rest mainly from Hammersley and Broken Hill. The North Koreans supply probably roughly 1.5 million tons of iron concentrate annually to China. Rio Doce of Brazil concluded a deal at yearend 1978 to export over 2.5 million tons of iron ore and 200,000 tons of pig iron during 1979-80 and expects a long-term contract thereafter. India, through the Minerals and Metals Trading Corp., have also made trial shipments to China in 1978. With the establishment of the Baoshan "coastal" steelworks, overall iron ore imports should rise sharply in the future.

One of the most intriguing aspects of steel developments in China is the establishment of the Baoshan Steelworks with Japanese help. Nippon Steel's board chairman Inayama has had a fine hand in this project, as well as in China-Japan trade in general, Japanese purchases of Chinese oil, and sale of Japanese steel and industrial products to China. It comes as no surprise that China's first coastal steelworks will be built by a consortium headed by Nippon Steel, the largest steel company in the world. The preliminary protocol was signed in April 1978, and by June, the Chinese were asking for the delivery of 240,000 tons of pipe pilings for the foundations (total of 600,000 tons for the project) during the remainder of the year. A launching ceremony for Baoshan took place on December 23, 1978, attended by China's Vice Premier Ku Mu and a 100-person delegation from the Japanese steel industry. This integrated steelworks, with an initial capacity of 6 million tons per year of crude steel, will be equipped with two 4,000-cubic-meter ultramodern blast furnaces, along with three 250- to 300-ton oxygen converters (BOF's), continuous-casting mills, and various rolling mills. Such a project will cost many billions of dollars. The first stage of the Baoshan Steelworks was originally scheduled for completion before the end of 1981, and the second stage, before yearend 1983, but there will be at least 1 year's delay.

West German firms may have the best chance to be selected to build the temporarily shelved Chitung (Jidong) Steelworks, to be located most likely in Luan Hsien near the coalfields and the port city of Chingwangdao, both in Hebei Province and not too far from the new Szechiaying iron mine and the older Chiennan iron mine. Schelemann-Siemag AG heads a consortium, including Dresdner Bank AG, Siemens AG, Thyssen AG, and Sterkrade AG, that made a $14 billion bid to build this integrated complex; the bid includes a buyer's credit repayable in 10 years.[16] The original hope was to install two 4,000-cubic-meter blast furnaces and three 300-ton BOF's by about 1985. The plan to complete expansion of the Szechiaying mine to supply Chitung, with the help of Kaiser Engineers, Inc., in building new mines and beneficiation and pelletizing facilities, however, was being implemented under a slower schedule.

Although exact plans to expand the Anshan Steelworks may not have been settled as of early 1979, the intention to make it into China's largest metallurgical complex is clear, possibly producing as much as 15 million tons per year of crude steel. Anshan already ranks about 20th among the world's steel complexes. Nippon Steel indicated [17] that it might take the lead to modernize and expand it in a manner similar to what was done at Japan's Yawata Steelworks, which would mean replacing Anshan's smaller blast furnace with large new ones, and older open-hearth steel furnaces with modern top-blown BOF's. A subsequent report[18] mentions a Sumitomo Metal Industries proposal to build a new 6-million-ton-per-year plant near the present Anshan Steelworks and modernize the existing plant, all for completion around 1985. The Chinese themselves are moving ahead to enlarge existing facilities and develop new ones. On January 5, 1979, a $1 billion contract was signed with United States Steel to build a mine plant at Chitashan (Jidashan)-one of Anshan's mines capable of producing 17 million tons per year of pellets plus 3 million tons per year of iron concentrates by 1983.[19] However, this program had not yet commenced by early 1980.

Anshan has 11 blast furnaces, including one of 1,513 cubic meters in size, another of 2,000 cubic meters, and the newest one of 2,580 cubic meters, which alone can produce about 1.5 million tons per year. The latest furnace is entirely Chinese built, and has been installed where No. 7 and No. 8 used to be. Anshan has about 25 open-hearth furnaces of various sizes and at least two 150-ton BOF's. The management has introduced top-blown oxygen practice to open-hearth operations with considerable success, and this has greatly increased Anshan's steelmaking capacity.

The Capital, Shoutu, or Peking Steelworks, located only 20 kilometers from the heart of Peking, was doing well in production and was being modernized and expanded during 1978 and 1979. With 1,000-cubic-meter and 1,200-cubic-meter blast furnaces, plus two other smaller ones, Peking produced about 2.3 million tons of pig iron and 1.3 million tons of steel in 1978. In the spring of 1979, a new 1,327-cubic-meter blast furnace was placed in operation, to replace the old No. 2 516-cubic-meter furnace. Peking was proclaimed as the leader in blast furnace practice within China, achieving a coke ratio of less than 450 kilograms per ton.[20] Pig iron output in 1978 was said to be about 45% higher than in 1977. Japan's Nippon Kokan advanced a proposal to build a $4.5 billion, 5-million-ton-per-year new integrated steelworks alongside the existing one.[21] The Peking Steelworks currently obtains iron ore from the Lungyen and Suichang Mines near Chienan. Located about 220 kilometers east of Peking, Suichang produces about 2 million tons per year of concentrates from 5 million tons per year of low-grade ore. The long-range plan is to produce 18 million tons per year of crude ore, utilizing both the magnetic and nonmagnetic portions to make pellets as well as concentrates.

The Benxi (Penchi) Steelworks in southern Liaoning Province near Anshan has been converted from a blast furnace works to an integrated steelworks. It has a new 2,050-cubic-meter blast furnace and four other blast furnaces (two larger ones about 900 cubic meters), capable of producing about 3 million tons per year of pig iron. A 1.6-million-ton-per-year sintering plant and a 65-slot, 370,000-ton coke plant have been completed fairly recently. Benxi's No. 2 steel plant became operational in 1978; three modern BOF's of Chinese design, probably 120 tonners, were installed in this plant. Benxi Steelworks produced about 2.5 million tons of steel in 1979. Iron ore comes from the nearby Waitoushan and Nanfen mines. Waitoushan has some high-grade ore, but Nanfen is mainly low grade, now producing about 7.5 million tons per year of raw ore. Kaiser Engineers, Inc., has the job of greatly expanding Nanfen by 1981 to accommodate future needs of new steelmaking facilities. Japanese steel firms, and possibly others, have made bids to add 4 to 5 million tons per year of steel capacity at Benxi.

The integrated Wuhan Steelworks had a bad year in 1979, producing only about 2.5 million tons of steel, because of power shortages. Steelmaking capacity may be closer to 3.5 million tons per year. Wuhan's steel output in 1978 was said to be 26% higher than the previous peak output, and pig iron, 11% higher.[22] Wuhan has three 1,500-cubic-meter and one 2,500-cubic-meter blast furnaces, four byproduct coke plants, nine open-hearth furnaces (most 500 tons), three small converters, and old hot rolling, plate, and rail mills. If Wuhan is to expand steel production to more than 5 million tons per year, large BOF's probably will be installed to replace some open hearths.

Installation of new West German and Japanese equipment has been behind schedule. It was not until mid-October 1978 that the 1-million-ton cold strip mill and the 70,000-ton silicon Sendzimer mills were placed in operation on a trial basis.[23] Apparently, the 3-million-ton hot strip mill, the 1.5-million-ton-per-year continuous casting mill, the 300,000-ton-per-year tinning line, and the 150,000-ton-per-year galvanizing line had not been completed by early 1979. However, everything should be in place by late 1979, and 1980 could be the year that Wuhan will be finally operating at design capacities. Wuhan uses mostly local iron ore from the Tayeh (Dayeh) open pit and the Zhenghai and Dahungshan underground mines, but increasing quantities of outside ore probably will have to be brought in in the future. Wuhan uses locally beneficiated sinter feed and has finally brought down the coke ratio to less than 500 kilograms per ton of pig iron.

Shanghai now has about eight small steelworks, together producing probably about 5 million tons per year of steel. Shanghai No. 1 Steelworks, the largest, was targeted at 1.8 million tons for 1979. the Taiyuan Steelworks apparently produces over 1 million tons per year of steel and 2 million tons per year of pig iron and expects to double steel production. It has small Austrian BOF's, and Voest-Alpine, which installed them, may have the inside track to build a large steelworks. Taiyuan brought the large Okou open pit and mill into production during 1977. The Baotou (Paotou) Steelworks in Inner Mongolia, with three blast furnaces of 1,513 to 2,000 cubic meters, small BOF's, and blooming mill, may be producing at the rate of about 1.1 million tons per year of steel. Baotou did well in 1978, reportedly fulfilling its steel plan 43 days ahead of schedule and establishing a record high.[24] Maanshan in Anhui is another steel center producing more than 1 million tons per year, and a new steelworks came onstream at yearend 1979. The ore is local, and a large number of small blast furnaces converts it into pig iron for use at Maanshan and nearby Shanghai. Visitors to the Chungking (Zhungching) Steelworks in Sichuan claim that its output is considerably less than 1 million tons per year. However, China revealed the completion of a 1.5-million-ton-per-year steelworks called Panzhihua in Sichuan Province near Dukou on the Chinsha River and was expected to expand facilities immediately.

The Tangshan Steelworks in Hebei, which was rehabilitated after the earthquake, seems to be the largest of the medium-size plants and capable of producing over 2,500 tons of steel daily. China has many other medium-size plants of 200,000 tons per year or more, including Changchun in Heilongjiang, Tunghua in Jilin, Dalien in Liaoning, Tianjin and Handan in Hebei, Anyan in Henan, Jinan in Shandong, Changchih in Shanxi, Lanzhou in Gansu, Dayeh in Hubei, Xiangtan and Lienyuan in Hunan, Nanking in Jiangsu, Hangzhou in Zhejiang, Chengdu in Sichuan, Kunming in Yunnan, Guizhou and Liuzhou in Guangxi, and Jiangbei and Canton in Guangdong. There are probably another 30 plants producing in excess of 50,000 tons per year, and 500 more smaller ones. These medium and small steel plants together produced 7 to 10 million tons of steel in 1978.[25]

Lead and Zinc.—According to Chinese officials at yearend 1979, China has the capacity to produce 250,000 to 300,000 tons each of refined lead and zinc annually. These figures seem high in the view of most western observers. Mine lead should be less than refined lead because of the scrap component, whereas mine zinc would be close to refined zinc output. The annual shortage of lead has been about 50,000 tons in recent years. Smaller quantities of zinc are imported, and occasionally some zinc has been exported also. The general lead-zinc shortage situation cannot be corrected until more deposits are developed, more mines expanded, and more smelters built. With the modernization program underway and the buildup of industries, demand for these metals should increase sharply, and it would not be surprising if consumption should rise to 500,000 tons per year or more for each metal within a decade. China's lead-zinc potential is much more promising than had been earlier thought, and in fact may prove considerable when carefully investigated. There seem to be many new deposits, and much additional exploration can be done.

The most interesting new development was the request for Japan's Mitsubishi Metal Corp. to assist in the development of China's lead and zinc industry.[26] The Japanese mission visited the Shenyang smelter in Liaoning, the Zhuzhou smelter in Hunan, and the Fankou mine in Guangdong, and other mines and metalworks during November 10-23, 1978. The Shenyang smelter has annual capacities of 40,000 to 50,000 tons of copper, 40,000-50,000 tons of lead, and 15,000 to 20,000 tons of zinc. The Japanese say that the Zhuzhou smelter, which is about 20 miles east of Hsiangtan, is rated at 120,000 tons per year of zinc and 50,000 tons of lead. Fankou has an annual capacity of 50,000 tons of combined mine lead and zinc (about one lead to two zinc) which the Chinese want to boost to 150,000 tons according to Mitsubishi. At Shenyang and Zhuzhou, the Chinese want to modernize facilities, including installation of pollution control equipment, with a view to expanding production considerably.

At Fankou, plans are to install up-to-date mining and beneficiation equipment and facilities. Fankou happens to be about 25 miles north of Shaoguan where the Imperial Smelting Process (ISP) people were licensed to build an ISP smelter rated at about 35,000 tons of zinc and 18,000 tons of lead; apparently, the Shaokuan smelter was never operated at full capacity. Mitsubishi was also asked to look into the development of three large lead-zinc deposits found through China's own efforts in Tsinghai Province (Sitiehshan), Gansu Province (Chengxian), and Sichuan Province, including integrated smelting facilities. The Chinese would like to undertake projects through production-sharing arrangements, but the Japanese would like to have part of the deal settled in cash.

Toho Zinc Co. (Japan's No. 2 zinc refiner) and C. Itoh & Co. were negotiating with the Chinese to build a 100,000-ton-per-year zinc refinery at a cost of more than $160 million.[27] At least one of the West German nonferrous refineries is a lead plant. There is a smelter in Sungbei, Hunan Province, that may be rated at 10,000 tons per year of lead and 5,000 tons per year of zinc. Fujien Province has a small smelter called Liencheng. Facilities have also been mentioned for Wuhan, Canton, Changchun, and Kunming, but these are mainly lead plants and apparently small. Shanghai has a 6,000- to 7,000-ton-per-year lead refinery cleaning up lead buillion from Hunan, in addition to larger copper refining facilities.

China's oldest lead-zinc mine is Shuikoushan in Hunan Province, which supplies the Sungbei smelter, among others. Around 1972, this mine had a capacity to produce 1,000 tons of ore (2.5% Zn, 1.2% Pb, and 2 grams Ag) per day from ore reserves of possibly 20 million tons. Apparently new ore bodies have been located deep below present mining areas of Shuikoushan. Also, rich nonferrous resources have been located in 10 other mining areas of Hunan, including Panchiachung. The Taoling lead-zinc-fluorspar mine in Hunan may be producing 3,000 tons of ore daily (about 2.5% combined lead-zinc and 10-15% fluorite), which might be equivalent to 15,000 tons per year of zinc and 10,000 tons per year of lead. A small lead-zinc mine with more than 1,000 workers has been opened in Hengtung County, Hunan; in early 1977, Hengtung had two beneficiation plants (probably both of 200-ton-per-day size), which turned out perhaps 3,000 tons per year of combined lead-zinc and 20,000 tons of fluorspar. There is a relatively new lead-zinc mine near the Liencheng smelter, located in the middle part of western Fukian. Huili in Sichuan is well known for zinc. Guangxi has a lead-zinc mine called Sidin. Xinjiang Province reportedly produces lead-zinc ore. Liaoning Province has small lead-zinc mines like Chingchengtzu (near Fushun), Hsiuyen, and the newly reported Chaiho mine in the northern mountainous region with 2,000 workers.

Molybdenum.—China's molybdenum production in recent decades has been centered at the Yangjiachangtzu mine near Zhinxi, Liaoning, where new reserves may be several million tons of 0.1%-0.3% molybdenum ore. The speculation is that output here has been more than 1,000 tons per year of concentrates. Molybdenum may occur in Sizhe, Xinjiang, and it is certainly present in Jiangsi's tungsten fields. Molybdenum might also be produced in Hunan Province. Of great potential importance, however, is byproduct molybdenum in China's porphyry copper resources. Specifically, molybdenum occurs within the ores of the large Tehsing (Dexing) copper deposit in Jiangxi Province being developed by the U.S. firm, Fluor Corp. Dexing ores analyze 0.4% to 0.5% copper and 0.03% to 0.08% molybdenum. There are already signs, therefore, that China could become a substantial producer and exporter of molybdenum a decade from now, just with presently known resources.

According to recent reports by Chinese geologists, large porphyry molybdenum deposits exist in Jilin and Shanxi Provinces, to make China even more important in world molybdenum supply. Lately, a number of lesser molybdenum deposits have also been found in coastal southeast China. Further, a sizable molybdenum deposit apparently has been discovered in western Hunan Province. One of these large deposits may already be in the process of development. With "moly" prices spiraling because of the special need for this strategic ferroalloy element in pipeline steels, the Chinese indeed have an incentive to develop a few really big mines. During 1978 and 1979, top management people from the U.S. firm, AMAX, visited China on various occasions, presumably to look over Chinese molybdenum (and tungsten) deposits.

Nickel.—China's nickel position was believed very weak at one time, with only one operating mine, Panshih in Jilin, having been mentioned in the press. Panshih is probably a small- to medium-size mine, and details are unknown. Cuba and the U.S.S.R. had been supplying China with nickel, with the latter stopping shipments in 1973. More recently, Canada sold about 42,500 tons of nickel to China during 1973-74 and much less thereafter. P.T. International Nickel Co. (P.T. INCO) has plans to sell Indonesian nickel indirectly through Japan to China. The Philippines is a potential supplier also. With more producers of lateritic nickel in the Pacific Basin, China should not have too much difficulty buying this metal.

In early 1979, the Chinese started to talk about a large nickel-copper sulfide deposit called Jinchuan in western Gansu that they had worked on for about 20 years. Several U.S. consultants had an opportunity to visit it also. Apparently, the property had been well drilled, although with a minimum of diamond drilling. There is a mine already, designed and built by the Chinese and capable of producing 10,000 tons per year of mine nickel plus copper. Reserves are said to be about 5 million tons of contained nickel, 3.5 million tons of mine copper, and 100,000 tons or more of cobalt in 0.8% to 1.0% nickel (also 0.5 to 0.6% Cu) ores. No doubt the Jinchuan mine will be greatly expanded in the not-too-distant future, especially since part of the deposit can be mined by open pit. Very likely, large-scale development would require foreign financial and technical help. Some of the nickel might be sold abroad in the future to pay for foreign services rendered.

Platinum Group Metals.—A major deposit of platinum, palladium, osmium, and iridium reportedly was discovered in the Dali area of western Yunnan Province, in 1971 by a provincial geological prospecting team.[28] Subsequent drilling has proved up the deposit. The Chinese feel that this discovery at Jinbaoshan in the Mitu area points the way to possible additional finds in the future. It was also reported that large chromite discoveries in the Tibet Plateau have high values in the platinum-group metals.[29] These metals are essential to China's industrialization and defense programs, and most requirements have had to be met by imports.

The Precious Metals Research Institute of the Ministry of Metallurgy has succeeded in making precious metal alloys of over 100 grades and 1,000 specifications since 1963. Before that time, China had to import all the alloys of gold, silver, platinum, rhodium, iridium, osmium, and ruthenium. Researchers made an alloy for conducting electricity in an instrument for aerospace use, whose wear resistance as a contact material is much better than imported platinum or palladium-based alloys. In May 1977, a new alloy containing 6% silver was developed for medium-load electrical equipment to replace pure silver; further, practical application problems have been solved. In June 1977, the Institute successfully made a palladium alloy amorphous film with good tensile strength and high resistance to wear and radiation, for use in nuclear energy and other fields of modern technology.[30]

Rare Metals.—Within 20 years China has emerged as a very important producer of rare earth and rare metals, both for the domestic market to meet the needs of the metallurgical, nuclear, chemical, electric, electronic, semiconductor, and special industries and for export. Chinese resources of rare-earth minerals are large, diverse, and widely distributed. In 1978, a new mineral, $(PbNbO_4)$, was discovered in the Kangshan District of Changpaishan, Jilin. Guangdong Province's rare metals economy has become rather sophisticated and important. A National Conference on Rare Earths was recently convened at Paotou in Inner Mongolia, one of China's rare metal and steelmaking centers. Baiyunnobo, north of Paotou, has recently been described as a "mineral storehouse" for rare-earth minerals and by far the most important in terms of reserves. There is a Rare Earth Institute in Lanzhou in Gansu Province. China has also developed a high-purity metals industry capable of making 99.9999% pure tellurium, arsenic, cadmium, gallium, and germanium, along with many other metals of slightly less purity, including copper, lead, zinc, tin, bismuth, cadmium, antimony, gallium, nickel, phosphorus, sulfur, boron, arsenic, and lithium.

Guangdong Province reportedly has mastered beneficiation and extraction technology related to 40-odd types of rare metals.[31] During the fourth 5-year plan (1971-75), output value increased threefold each year to meet the needs of metallurgical, nuclear energy, chemical, electric, electronic, semiconductor, and other high-technology industries. Developments at the Pantan tin mine are worth mentioning. Discovered in 1958 for tin, this mine reportedly recovers 11 types of byproducts which together constitute two-thirds of the mine's output value. Germanium used for defense purposes is a new byproduct recovered, and technology has progressed to a state that germanium recovery has reached 75%. Kwangtung Province obviously has a surplus of rare metals.

The Japanese have good knowledge of China's "rare" metals industry, because of purchases of raw materials and sales of products and technology.[32] At yearend 1978, the Chinese made a special bid to sell rare metals (especially columbium or niobium) from Sinkiang to Japan. Sanyu Trading handles most of Japan's imports of Chinese rare-metals raw materials and manufactured products. A fluorescent-material plant is being built in China by the Japanese firm, Dai-Nippon Toryo Co., Ltd., for completion by 1980, to use all Chinese raw materials eventually but some Japanese intermediates in the meanwhile. China's yttrium is produced from xenotime, and its rare-earth chlorides contain as much as 0.2% europium. Mitsui Mining & Smelting Co., Ltd., of Japan, after visiting China for the second time at yearend 1978, reportedly offered to help develop rare metals in Inner Mongolia and Kiangsi Province on a production-sharing basis. Samples of ores analyzed revealed contents of samarium, cerium, yttrium, lanthanum, europium, and tantalum.

Apparently, China has abundant niobium resources and is producing niobium powder, bars, ingots, and oxide for use in steel metallurgy, electronics, optical glasses, chemicals, and especially superconductors. China also produces and exports beryllium-copper alloys, ferrotungsten, tungsten powder, other ferroalloys, and electrolytic manganese. Aside from exporting rare metals and compounds, China also sell concentrates such as xenotime, niobite, zircon, lithium mica, spodumene, single silicon crystal, and natural and synthetic quartz crystals. The best niobite is better than 60% in grade and contains impurities of less than 6% TiO_2, and 5% WO_3. Niobite is the source of columbium, tantalum, and their oxides. The top-grade zircon concentrate is better than 65% and contains less than 0.3% TiO_2 and 0.2% Fe_2O_3. Zircon, the main source of zirconium and hafnium, is used in China in nuclear energy, metallurgy, casting, refractories, glasses, and the making of special-quality alloys.

Tin.—Significant geological work has been done on the tin in southwest China. New tin deposits have been discovered in the tin mining districts of southern Yunnan, the western part of Yunnan Province, and north as far as western Szechuan. Within the northern part of the "Kang-Tien" (Sikang and Yunnan) axis, a tin sulfide deposit has been discovered and the potential seems good. Currently, a large skarn iron deposit with tin content is being investigated, and apparently the occurrence of tin in this western location in Liaoning Province is even more widespread than the iron. The tin here is of industrial value. (Tin in iron ore happens to have precedence in Malaysia, where tin was recovered nicely, but iron ore with tin was hard to market.)

Expanding and further modernizing the Gajiu (Kuchliu) Yunnan complex (which provides over 60% of China's tin) no doubt has been planned; this would entail integrated activity from exploration and development to extraction and refining. Conceivably, people who know about Bolivian tin mining and smelting could aid the Chinese in working the "dirty" Yunnan tin. The Guangxi "clean" placer tin from the Fuhochung District apparently has great potential, although currently employing techniques 20 years behind those of Malaysia, with few magnetic and electrostatic separators, tables, and good gravel pumps. Fuhochung deposits are not only amenable to the various "hydraulic" methods, but also to dredges in some places as well. Malaysia could help China mine placer tin, although there are some political problems at present. Apparently, a new smelter is being built somewhere in Guangxi. Reportedly, several tin deposits have been discovered in Hunan Province. There is a tin mine in Guangdong called Pantan whose output value is one-third in tin and two-thirds in byproducts (mainly rare-earth minerals).

A large complex tin deposit is being developed somewhere in Guangxi 100 miles from the Vietnamese border.[33] The mining area is said to extend for 60 miles, with reserves of contained tin at about 800,000 tons. The Chinese had previously announced that three large and two small nonferrous deposits had been discovered in the Hechih area, center of Guangxi's placer tin district. Apparently, the first phase of the new mine-mill complex had just been completed and construction of the second phase was underway. In the first phase alone, it was said that production of tin ore would reach 1 million tons annually, from which 4,000 tons of tin, 20,000 tons of zinc, 5,000 tons of lead, 3,000 tons of antimony, and significant amounts of rare and precious metals plus sulfur would be recoverd. This complex would certainly need a smelter, but it is not known whether the "Guangxi" smelter previously referred to is a "lode ore" smelter or a simple placer tin smelter.

In view of the ongoing modernization program, Chinese tin is becoming more important to China than the outside world. If China's steel production is to be doubled within a decade, then tin consumption should definitely top 20,000 tons per year, which is roughly twice current levels. Exports of Chinese tin (metal) has declined from more than 15,000 tons (large tonnages from stocks) in 1975 to some 7,000 tons in 1976, and 5,000 tons in 1977, and perhaps only 3,000 tons in 1978. The Billiton subsidiary of Dutch Shell has handled a large part of Chinese exports of tin, approximately 40% of which has come to the United States. The recent iron mines development contract signed with United States Steel stipulates partial payment by Chinese tin. This means that smelting facilities are adequate for present production estimated at about 20,000 tons per year. In view of the considerable resources, raising output by at least 10,000 tons per year seems a reasonable goal.

Titanium.—The Chinese have displayed titanium rods and sheets at one of the recent Canton Fairs, which implies that they may be able to produce titanium tetrachloride and titanium sponge. However, a commercial-size plant probably does not exist, in view of China's renewed interest in Japanese titanium technology. Companies like Kobe Steel, Osaka Titanium, various Sumitomo enterprises, and Toho Titanium were making plans to bid on the construction of such a plant, along with the British firm, Imperial Chemical Industries. Toho Titanium Co. recently completed a $3.3 million titanium trichloride catalyst plant within a petrochemical complex 50 to 60 kilometers from Peking, and officials of this company indicated that the Chinese seem to have sufficient supplies of raw materials like tetrachloride and sponge.

China has had many decades of commercial connections with Ishihara Sangyo, Japan's leading titanium dioxide producer and exporter. Ishihara signed a contract to supply China with 3,600 tons of rutile and anatase type of titanium dioxide worth $4 million.[34] Titania is used in making fibers, pulp, rubber, synthetic resin, paints and varnishes, and electric appliances, mainly as a white colorant. The Chinese themselves make some low-quality titanium dioxides. Overall, Chinese demand for this material has risen to about 1,000 tons monthly. When this reaches 2,000 tons, the Chinese might consider construction of a modern titanium dioxide plant within China.

The new Panzhihua Steelworks in Sichuan recovers a slag containing 30% titania plus vanadium. Possibly this can be upgraded to provide a titanium raw material.

Tungsten.—China has long been considered as having the largest reserves of tungsten in the world. Most Chinese ore is high-grade wolframite from the Dayu (Tayu) District of Jiangxi Province, but scheelite from Hunan Province has become important, and significant deposits have been found elsewhere in southeast China, particularly Guangdong and Guangxi. The best known mines in Jiangxi are Xihuashan (Hsihuashan), Dajishan (Tachishan), Gueimeishan (Kweimeishan), and Pankushan. Considerable recent exploration has been done on the known deposits of Jiangxi, including use of modern geophysical methods and studying the correlation of tungsten mineralization with tectonic systems, to locate "hidden" ore bodies (in fringe areas and at depth) and rejuvenate old mines. A typical large Tayu mine has hundreds of steep veinlets in a mineralized zone of several square kilometers with reserves of possibly 100,000 of WO_3 contained in ores assaying 1.2% WO_3 and 0.5% tin. Ore production is in the 2,000-ton-per-year range. Yangohiatan may be one of the scheelite mines in Hunan, but there are small wolfram mines in Tucheng County. Three better known mines in Guangdong are Yangjiang, Shihjenchang, and Yaoling.

According to Chinese geologists, some new types of ore bodies have been found in recent years that enlarge the tungsten resource base and open new avenues for exploration. For example, the Jiangsi Province traditional types are the quartz-vein wolframite ore bodies and skarn-type scheelite ore bodies. Included among the new types are black tungsten ore bodies formed by ultra-acidic sodium granitic intrusion; black ore bodies formed in fine veinlet intrusions of ultra-acidic mica quartz; and porphyry tungsten ore bodies, breccia ore bodies, and bedded multistage mineralization tungsten ore bodies related to weakly acidic granodiorites. Another important new development is the fact that tungsten mineralization has been found in various locations outside of southern China. In fact, good deposits occur in the Tienshan fault-fold system of the northwest and the Chilienshan fault-fold system of northern China.

China's participation in the United Nations UNCTAD and the Primary Tungsten Association meetings in Geneva has not yielded much new information. However, a January 1979 trip to China by a U.S. "refractory metals" delegation did shed some light on the status of the tungsten industry. This delegation in visting the country's largest tungsten mine, Hsihuashan in Jiangxi, indicated that it has about 600 small, discontinuous ore bodies and a dozen levels (half on hillside), is fairly mechanized (3,000 employees), and produces 2,500 tons per year of concentrates. There is an acid-power plant using wolfram as raw material somewhere in Hunan, and a 1,000-ton-per-year tungsten carbide plant at Zhuzhou (Chuchow) with 2,000 workers. A 118,000-ton "reserve" wolfram deposit with 1.3% WO_3 grade ores, recently found in Guangxi Province, is scheduled to be developed into one of China's key "colored metals" projects. Interestingly, a 5-year Sino-French accord, signed in late 1978, calls for one of the scientific projects to be a geological study, principally of tungsten resources by the French. Very recent news indicates that the Chinese may be interested in an American bid to build a 2,000-short-ton-per-year paratungstate plant (perhaps mine also) specifically aimed at export. China's overall tungsten output in recent years has been estimated at about 17,000 tons per year of concentrates (or 9,000 tons per year of tungsten content) compared with possibly 9,000 tons per year of exports. Production can be greatly increased, and it may be higher than estimated, although the Chinese do not wish to disturb world prices.

Uranium.—The Chinese stated without details that their nuclear effort had become integrated, that they will redouble efforts to attain world technical levels, and that very extensive resources of uranium had been ascertained.[35] They further stated that many of the new discoveries had been made in new types of geologic horizons. One of the general areas mentioned for metalliferous and uranium ore finds is the Yunnan-Guizhou Plateau. A yearend 1979 report notes that the biggest uranium deposit in China, with 100 rich veins covering 100 square kilometers and occurring in granites, has been discovered.[36]

In earlier years, China's uranium came from places like Chuannan in Guangxi and Weiyuan in Guandong. Part of the ore extracted in the past went to Czechoslovakia to pay for the assistance rendered, with some of the beneficiation even done in that country. Uranium and other radioactive mineral occurrences have also been reported for Xinjiang, northeast China, Inner Mongolia, Qinghai, and southwest China. The Chinese say that they have discovered a new uranium mineral called Ziangjinaite. Africa's second-ranking uranium producer, Gabon, offered to sell uranium ore to China a few years ago in exchange for Chinese financial and technical aid in agriculture and industry. Late in 1978, it was reported that the European Economic Community may be interested in buying uranium raw materials from China.

The Chinese interest in nuclear energy has grown considerably during the 1970's after first exchanging visits with the Japanese and Canadians about 6 or 7 years ago. Very likely, the Chinese are thinking about large-scale nuclear power generation by the 1980's. There is some uncertainty about how fast they want to get into this field. In December 1978, as part of an almost $14 billion, 7-year trade agreement with France, the Chinese would get help from the French in constructing two 900,000-kilowatt nuclear generating plants along with the enriched uranium. The contract of building light water reactors presumably was to go to the Framatome unit of the Empain-Schneider Group licensing from Westinghouse Electric with U.S. approval. Subsequently, the Chinese had second thoughts about these nuclear plants.

Vanadium.—The China Society of Metals indicated that a new iron smelting technique had been developed at the 1.5-million-ton-per-year Panzhihua Steelworks in Sichuan.[37] Specifically, a ferrotitanium separation process was used to smelt vanadium-titanium magnetite ores in a blast furnace that allows the titania content of the slag to reach nearly 30% without ill effects. The mixed slags were further treated to yield tens of thousands of tons of vanadium slag annually. This process opens the way for development of similar deposits in the southwest.

NONMETALS

Asbestos.—China's production of asbestos has increased considerably during the last decade. As a world producer, China now ranks about fifth and provides roughly 5% of the world's total output. Demand has risen steadily, and many kinds of asbestos products are made to meet industrial requirements. Historically, China first used asbestos about 2,000 years ago for fire insulation, asbestos paper, and asbestos-lime-cement "fire pots." In recent years, the Chinese have had small surpluses of asbestos and asbestos products for export.

The foremost deposit in the country by far is Shihmien (which means asbestos in Chinese) in Sichuan Province. Shihmien's overall ore zone is said to be 6,300 meters long and 350 meters wide, with reserves of several tens of million tons of ore grading better than 2%. Chrysotile fibers of 2 centimeters or longer represent more than half of the total production. The best sample shipped to Geneva for exhibit was 1.3 meters long and the size of a bucket in circumference. There are over a dozen fairly up-to-date projects at Shihmien, including a good beneficiation mill, powerplant, and aerial tramway. Sichuan has a second major asbestos deposit called Penghsien, not too far from Shihmien.

Apparently, various lesser deposits are located in a belt from Jilin and Liaoning Provinces in the northeast to southwest China, passing through Hebei and Shanxi Provinces and Inner Mongolia. Asbestos fibers from Jilin and Taan, Shanxi, are said to be brittle but long. Those produced in Jin Hsien, Liaoning, are medium long and strong, suitable for making asbestos-cement products. Outside of Sichuan, the asbestos deposits of Laiyuan County, Hebei, are probably the most productive. The ore body known in the past embraces 5 to 20 veins (1 to several meters wide) that extend several kilometers in length. The chrysotile asbestos of Laiyuan is 2 to 5 centimeters in length, high in tensile strength, and suitable for high-quality products. Asbestos has also been discovered in Yuanjiang County, Yunnan Province.

Barite.—Chinese barite has been in great demand for oil and gas drilling. As of yearend 1979, production capacity had reached the 500,000-ton-per-year level, which represents 8% to 9% of the world total. China has exported anywhere from 40,000 to 120,000 tons per year of barite; and Chinese barite comes in three grades, 90%, 95%, and 97%. Europe and Japan are the principal markets. China has added various barium compounds to the list of exports in recent years. In 1977 and 1978, Japan imported an average of about 20,000 tons of barite and 10,000 tons of barium compounds annually from China. The Japanese say that China is using increasing quantities of barium compounds themselves for Braun tubes and ferrite magnets.

China's best barite deposits are probably replacements in limestone, dolomitic sandstone, shales, and residual materials. Extensive barite resources have already been found in China, and geologically probably much more can be discovered. Known deposits seem to be high quality and easy to extract, and reserves must be in the tens of millions of tons if not more. Known producing areas include Tangshan in Hebei, Hwanshan in Shandong, Xiuren in Guangxi, and Linchuan in Jiangxi. Large and high-grade barite deposits have been recently found in seven counties of Hubei Province.

Cement.—China's cement production capacity is firmly in fourth place behind the Soviet Union, Japan, and the United States, and considerably ahead of the Federal Republic of Germany, the fifth-ranked world producer. Output reportedly gained 17% in 1978 and more than 10% in 1979, over the previous years. As much as 60% of China's cement in 1979 came from perhaps 3,500 small cement plants, many of which have vertical kilns. About 20 of China's roughly 50 large- and medium-sized cement plants were said to have surpassed their full-year 1978 goals by late November. China has about four cement plants of 1 million tons per year or larger— Hantan in Hopeh, Yao Hsien in Shensi, Huahsin in Hupeh, and Liuliho in Peking— and up to 10 others of more than 500,000 tons. With regard to medium-size plants, China commonly builds rotary kilns of 30,000-ton-per-year to 100,000-ton-per-year sizes, the standard one being about 60,000 tons per year. Aside from ordinary portland cement, the current cement product lines include aluminous and phosphate cement; quick-setting, rapid-hardening, and high-strength cements; special cements for dams and oil wells; and white and colored cements.

Because of the improved stability and modernization programs, China was beginning to feel the temporary shortage of cement and other construction materials. Small purchases of Japanese cement were made by early 1978. Subsequent contracts with Japanese suppliers call for deliveries totaling up to 2 million tons of cement to China during 1979 at $60 per ton initially. (Price includes freight, to be renegotiated in May 1979.)[38] The effort to expand and modernize the large-plant sector had simultaneously begun. In August 1978, Peking sent inquiries to Kawasaki Heavy Industries, Ishikawa-Harima Heavy Industries, Mitsubishi Heavy Industries, and Kobe Steel regarding construction of new cement plants at about $200 million each. Although everything was still in the discussion stage, Kawasaki sent a mission to China rather quickly, and one of these firms probably will land the first contract. As an alternative to expensive new plants and to complement them, Japan's second largest cement producer, Nippon Cement Co., landed a contract to help modernize existing plants.[39]

Nippon Cement is expert in the fuel-efficient new suspension preheater system (NSP), which can greatly increase the capacities of existing horizontal rotary kilns. While on a mission to China visiting cement plants at Nanjing, Shanghai, and Liuzhou, Nippon Cement was asked to submit a tender aimed at boosting Liuzhou plant's capacity from 0.6 million tons per year to 1.5 to 2.0 million tons per year. This deal, if proven successful, would be a breakthrough for both parties concerned. Although details are not known, China is clearly formulating ambitious plans to expand the large-plant sector by both indigenous efforts and foreign help.

Diamond.—China's need for industrial diamonds has steadily increased, particularly for drilling purposes. Until 1971, most of the diamonds were imported. It was around this time that the Changde diamond mine in the Yuanjiang Basin of western Hunan was brought into production. Diamond deposits had also been found in Guizhou and Shandong Provinces. In mid-1978, a large diamond deposit reportedly was discovered in Liaoning Province after 5 years of geological work. Two years later, a single diamond weighing 159 carats was discovered in the Linshu County of Shandong Province by the Changlin brigade, after which it was named.[40] Apparently, the Chinese are seeking western help to develop the natural diamond industry.

In late 1973, synthetic diamond manufacture began, after the Institute of Physics of the Chinese Academy of Sciences and the Peking Grinding Wheel Works had jointly produced diamond crystals larger than 1 millimeter by the explosion method. More than a dozen units were "growing" inexpensive synthetic diamonds by this method for use in metallurgy, geological prospecting, oil extraction, machine manufacture, instruments, and defense industries. The most recent research work was in the agglomeration of small synthetic diamonds for industrial use. It was said that synthetic diamond drill bits were used to drill China's deepest oil and gas drill holes somewhere in Sichuan Province. One of the synthetic diamond plants, Tungcheng, located in Peking, recently was commended for the good-quality polycrystal diamonds it produced for use in oil and gas drilling. Most Chinese geological teams now use domestically produced diamond bits in hard-rock drilling, oil drilling, and defense industries.

Fertilizer Materials (Nitrogenous).—China's 1978 overall production of chemical fertilizers, measured in terms of "100% effectiveness" (apparently reflecting nitrogen plus phosphorus contents), was reported at 8.69 million tons, or 20% more than in 1977.[41] Output for the first 11 months of 1979 was given as 9.57 million tons, or another gain of some 20%. Shandong, the country's leading fertilizer-producing Province, achieved its 1978 target 91 days ahead of schedule, and Sichuan, 84 days ahead of schedule. Twelve other areas also had met their 1978 goals by late November including Hebei, Hunan, Shanxi, Zhejiang, Guangxi, and Shanghai. The fertilizer industry likewise did well in terms of technical-economic indexes.

During 1979, small nitrogenous plants produced 7.3 million tons or approximately 55% of the national total. For the already completed seven large foreign nitrogenous fertilizer plants, operational times and production capacities generally increased. Among these, the Taching, Sichuan, and Shengli No. 2 plants had each already surpassed their 300,000-ton-per-year synthetic ammonia design capacity levels. Several additional large plants were completed in 1979, and the rest of the 13 ultramodern plants built or being built by foreigners are expected to be onstream in 1980 or 1981.

Well over 6 million tons of contained nitrogen were produced in 1979. China has about 25 large fertilizer plants and more than 1,300 small and medium plants scattered around the country; about one-tenth of these are located in Shandong and Sichuan. A few years ago, a typical small plant produced 3,000 to 5,000 tons per year, and medium ones, 50,000 to 100,000 tons per year; capacities of a great number of such plants have since been enlarged, and even many small plants are producing over 10,000 tons per year. In late 1978, Liaoning Province had 15 chemical fertilizer plants of various sizes, together furnishing 1.5 million tons per year.

Eight of China's newly acquired foreign "whole plants" were being handled by Pullman-Kellogg Co. and its Dutch subsidiary. Standard equipment included 1,000-ton-per-day ammonia units of Kellogg design and 1,620-ton-per-day urea units employing the Stamicarbon stripping process. Two other plants with similar size units and having Kellogg ammonia equipment were being built by the Japanese team of Mitsui-Toyo Engineering. The remaining three facilities had been awarded to the French-owned Heurtey Industries, which installed Haldor Topsoe ammonia (200,000- to 300,000-ton-per-year sizes) and Stamicarbon urea units. The 13 plants combined will be able to produce nearly 7 million tons of equivalent urea or 3 to 4 million tons of contained nitrogen when the last one comes onstream by 1980. The eight Kellogg plants are located at Wolitun within the Taching oilfield, at Panchin near Shenyang, Changchou in Hebei within the Renchiu oilfield, Chihshui in north-central Guizhou, Changlin in Hunan, Wuhan in Hubei, "shores of the Jin-sha-jiang River" in Yunnan, and within the Luzhou gasfields of Sichuan. Heurtey's plants are located at Nanjing (Jihsiashan), Anching in southern Anhui, and Canton (Whampoa). One of Toyo's plants is at Chengdu (Nachi) in Sichuan and the other is in Shandong Province, either at Jinan or within the Shengli oilfield.

The Peking oil refinery and petrochemical works has a large nitrogenous fertilizer plant. One of China's older but sizable plants is the Jilin fertilizer works. Two other fairly large plants were completed a short while ago, one in Hochih in Guangxi Province and the other in Ulashan in Inner Mongolia. Xinjiang also has a nitrogenous fertilizer plant. The latest one of Chinese build is the Chaoching plant near Guangzhou (Canton) designed at 110,000 tons per year of urea. The Chinese are talking about buying new foreign facilities and technology again, including Kellogg knowhow. In fact, a contract was signed in early 1979 with Kellogg Continental in Peking for a 1,900-ton-per-year plant, calling for additional consulting, training, and administrative services, as well as detailed engineering design, and equipment and materials. A licensing agreement was signed with Stamicarbon of the Netherlands for their urea plants of 1,620- and 1,740-ton-per-day capacities. One such unit probably will be built by the Chinese themselves near Shanghai in Zhejiang Province. Apparently, Ube Industries of Japan has won the bid to build a plant using residual oil from a nearby refinery to complete the above urea complex in Zhejiang. Lurgi Gesellschaften of the Federal Republic of Germany recently won a contract to build a 1,000-ton-per-day, coal-fired ammonia plant. Toyo Engineering will build nitric acid and nitrophosphate plants in Shanxi Province.

China continued to be by far the largest importer of nitrogenous fertilizers in the world, despite efforts to raise output sharply. Most imports by China have come from Japan. Ratified contracts called for Japanese delivery of 240,000 tons of ammonium sulfate, 850,000 tons of urea, and 270,000 tons of ammonium chloride during 1978; and 200,000 tons, 550,000 tons during the first half of 1979. Corresponding figures for Chinese imports from elsewhere are not known. However, during the second half of 1977, when Japan was supposed to deliver 542,000 tons of urea to China, 250,000 tons were scheduled to come from NITREX and 100,000 tons each were scheduled to come from Indonesia, Iraq, and Kuwait.

Fluorspar.—China has been an important producer and exporter of fluorspar for several decades, and annual output probably has been in the 300,000- to 400,000-ton range. A large surplus has been traditionally exported, mainly to Japan and the Soviet Union in the past, and more recently only to Japan, which took 111,147 tons in 1977 and 150,000 tons in 1978. However, Japan's fluorspar requirements for steelmaking have dropped sharply on a unit basis, and high-grade materials are preferred over Chinese metspar. Most Chinese fluorspar is metallurgical grade, although a significant share is acidspar. Very high-grade lump fluorspar was trial shipped to the U.S. market in recent years. China consumes possibly 100,000 tons of fluorspar annually, at least 50% by the steel industry and 25% by the aluminum industry. The country was becoming interested in hydrofluoric acid. Fluorspar demand should top 200,000 tons per year within a decade. The leading producing districts are Wuyi in Zhejiang Province, Kaiping in Liaoning Province, Lunghua in the former Jehol Province, Taoling in Hunan Province, and Pecheng in Fujian Province. Fluorspar has also been mined in Shandong and Guangdong.

Jade.—Exotic green-color jade is mainly a gem stone or ornamental stone, and there are no valuable synthetics. Some jades are somewhat whitish. The commercial term "jade" usually means jadeite to the Chinese but can also mean nephrite to other people. Jadeite is much more radiant in color than nephrite and commands a much higher price. Although southwest China is traditionally famous for jades, the best jade at one time came from upstate Burma, where Chinese merchants bought the crude blocks of stone encompassing jade and sent them to Hong Kong and elsewhere in the Orient for Chinese artisans to cut and sell. China's current work in extracting and cutting jade is little known. So far, little jade enters the world market, although this situation may change.

Peking officially reported that a large piece of probably crude jadestone, nearly 80 cubic meters in size and weighing more than 160 tons, was found somewhere in Liaoning close to the surface.[40] The huge stone was described as "emerald green tinged with vermillion, blue, and cream highlights." It was reported that significant deposits of jade and other precious stones were found in 11 locations within the autonomous region of Ningsia.[41] The types include agate, dark green jade, rose quartz, malachite, amethyst, ruby, sapphire, cat's eye, and transluscent agate. The deposits will be worked to produce agate ball-bearings, agate balls, and powder for industry, and grinding tools and measuring instruments including balances for scientific research.

Magnesite and Talc.—These geologically associated minerals, including soapstone, occur in a belt extending from Dashihchiao (Daling) northeast to Lienshanguan in Liaoning Province. The country's magnesite resources are very extensive by world standards and are reasonably high grade. Earlier western estimates of yearly production at about a million tons are far too low. The need for refractories in the steel industry is steadily expanding, and there is demand for magnesia in export markets such as Japan.

Chinese talc from Dashihchiao near Haicheng is very high grade and well known internationally. Japan, the main customer, imported 23,552 tons of Chinese talc in 1978 and 175,433 tons in 1977. Based upon these and other imports by other countries, China's talc production probably has surpassed 350,000 tons per year. In addition, possibly 150,000 tons per year of soapstone are also produced at Dashihchiao. Japan is again the leading buyer. Japanese statistics show that Japan also imported 10,494 tons of natural steatite in 1977 from China and 15,087 tons in 1978. The Luchuan deposit in Guangxi Province has been mentioned as a new area for talc and soapstone. Increasing quantities of talc, soapstone, and pyrophyllite will be needed in China for making paper and paint and for filling materials in general.

Phosphate Rock.—By raising phosphate rock production capacity to more than 5 million tons per year, China has cut down imports significantly since the early 1970's. Morocco tripled phosphate rock prices in late 1973, and this caused supplies from there to dwindle; later, however, Morocco adjusted prices downward. The Laokay area in Vietnam south of Yunnan Province was at one time an important source of foreign supply, but relations with Vietnam are indeed strained of late. In fact, the Laokay operation suffered severe damage in the recent conflict. Some Florida phosphate pebbles have been shipped to China in recent years, and a contract was signed in late 1978 with the U.S. Phosphate Chemicals Export Association to furnish China with 900,000 tons of U.S. phosphoric acid.[44] A Chinese Fertilizer Delegation had visited Florida near yearend 1978, and a five-man U.S. team of phosphate experts was subsequently invited to visit China. Basically, the Chinese policy is to develop indigenous resources as much as possible (in part with foreign help), and import whatever additional quantities that are necessary to meet expanding requirements.

China's phosphate rock resources are widespread throughout the eastern and southern areas of the country. Reserves may be rather extensive but the quality is uneven and often poor. Historically, the best known deposits are located in the Provinces of Yunnan, Guizhou, Hunan, and Hubei. Within Yunnan, there is recent news about two operations 5 miles apart and within 40 miles south of Kunming. Kunyang is the name of the older mine and Haikou is the new mine being developed. Kunyang's output has already reached 1.5 million tons per year, and its capacity is being expanded. Haikou has been described as a very large and high-grade phosphate rock deposit that is easy to mine, and the rock is suitable to make into compound fertilizers because of the low magnesia content.[45] Samples of the phosphate ore from Haikou were sent to the Albany (Oreg.) Research Center of the U.S. Bureau of Mines in late 1978 for characterization and beneficiation tests.

The ore, comprised of altered and unaltered phosphate, seems similar to the phosphate of the western United State; reserves at this mine amount to about 65 million tons. Yunnan officials were trying to popularize phosphate fertilizers, having conducted meetings in 1978 at producing areas like Chuching and Hsuanwei Counties, 100 and 150 miles, respectively, northeast of Kunming. Kaiyang, in Guizhou Province, to the north of Guiyang has one of the largest phosphate mines; and Fuchun, about 50 miles to the east of Kweiyang, is reported to have a very extensive deposit of high-grade ore (with iodine values), found near the surface and easily accessible to transportation.[46]

Liuyang, Shihmen, and Huachiao are known locations of phosphates mining in Hunan. The Chingxiang mine in Hubei had an annual capacity of 600,000 tons of phosphate rock. A 20-million-ton deposit may have been discovered in Chaoyangling, Jiangxi. Many localities in Foshan, Guangdong Province, have phosphate operations. A high-grade deposit was found in the Hsuaiyiling area (Datu River), Sichuan. Anhui has the Susung mine near Anching. North China's largest phosphate deposit is called Fangshan in Chulu Hsien, Hebei Province. A phosphate shale mine has started operations in Changbei County, Jilin. Shandong, with its many small mines, has emerged in recent years as China's leading phosphate-producing Province. Promising phosphate deposits have been found in Inner Mongolia and Liaoning Province.

The bulk of the phosphate rock supply is converted to chemical phosphates, although some is directly applied in the ground form. China must have over 1,500 small phosphate plants, which account for 75% of the national output. Shandong has nearly one-third of these plants, along with over 200 small phosphate rock mines and dozens of small pyrite operations. The rest of the "local" plants are rather spread out. Relatively important superphosphate plants have been built in places in Nanjing, Changsha in Hunan, Hunghochou in Yunnan, Shanghai, Taiyuan in Shanxi, Guangzhou and Changshou and Chanjiang in Guangdong, and Yingtan and Tungxiang in Jiangxi. The Chinese have started to use spent shales, cement wastes, slags, and boiler ashes for phosphate raw materials. In line with the thought of acquiring good foreign technology, a large nitrophosphate plant was ordered from Toyo Engineering of Japan in January 1979.

Potash.—Recent potash sales to China have been at record levels.[47] Canpotash Limited, representing Saskatchewan potash producers, signed a contract to ship 300,000 tons of muriate of potash from Vancouver between October 15, 1978 and June 30, 1979. During July and August 1977, Canpotash had shipped 50,000 tons to China. The Chinese have found that much more potash is needed to complement the many modern urea plants recently completed. Accordingly, they were looking into the matter of possibly inviting another Canadian potash technical mission to visit China in 1979.

Potash is being recovered from saline operations, sedimentary rocks, and various waste materials within China, although not yet in large quantities. Liaoning and brine works at Tzugung, Sichuan, have been recovering potassium chloride. At the Chaerhan salt lake works, Zhaidam, a very efficient potash recovery technique was successfully developed.[48] Deposits of potash in Shangong seem to be rather deep, but Shangong geologists found a sizable zeolite deposit which proved helpful in recovering potash from seawater. Kiln dust from cement plants and ashes from coal thermal plants have been used in various places as potash fertilizers. Guangdong Province has several dozen small potash-phosphate plants (together producing 600,000 tons per year) and another two dozen potassium-calcium fertilizer plants (combined 150,000 tons per year). Sichuan Province also has a number of small potash-phosphate plants in operation. Potash deposits were recently reported for Jiangcheng, Yunnan Province.[49] Once China starts to look seriously into its sedimentary potash potential, it is likely that important deposits will be found.

Pyrites.—Although generally short of sulfur, China should become much more important in the near future as a world producer of pyrite, because of mines being developed and new deposits found in recent years. Output capacity is already approaching 3 million tons per year, from principally two major pyrite mining areas—Ziangshan (Hsiangshan) in Anhui and Yingde (Yingte) in Guangdong. Also, pyrite in Sichuan Province has been converted to elemental sulfur, and sizable tonnages of pyrite are being extracted in Shandong Province. Two years have passed since it was claimed that China's largest pyrite project in the Yuanfu area of Guangdong had been half completed, including open pit, railroads, dock, water reservoir, and powerplant facilities.[50] In early 1979, it was further reported that construction had started on the Samsui (oilfield)—Maoming (shale oil and industrial center) Railroad which will have a bridge over the Xijiang (West River) and directly passes through the Yunfu pyrite center. A U.S. mining design firm apparently has been assisting in the development of Yunfu. Takungpao of December 21, 1979, reports that 15 million tons (30% grade) of additional pyrite reserves have been delineated in Yingde County and that "this is Guangdong Province's fifth large pyrite mine." A sizable pyrite deposit has been discovered in southern Sichuan near a coal base, and more prospecting is taking place. One-third of the uncovered ore can be easily mined, and good river and road connections also favor early development. Further, with the development of a large copper mines in Jiangxi and elsewhere in the future, byproduct pyrite production will become significant.

Salt.—For the first time, China reported its salt output—19.53 million metric tons for 1978.[51] This figure appears to be considerably lower than actual production, since the salt converted to industrial chemicals (including brine salt from Sichuan) is probably not included, and reported data are most likely incomplete. China is second only to the United States as a world producer of plain salt. Unlike the United States, which works on rock and brine salt, over 80% of China's salt is derived by solar evaporation from wind-protected shallow bay areas along the coast. A large part of Chinese salt is for food purposes, but industrial needs are climbing sharply.

Roughly 60% of China's salt comes from around the Pohai Bay. Within the bays of the Liaodong Peninsula, there are the Luda and Yingai salt fields occurring south of the Panshan oilfields near the mouth of the Liao River; the salt produced near Panshan is high in borates. The Tanggu salt field, China's largest, near Tientsin was damaged in 1977 by earthquakes, but were quickly repaired. The salt fields on the north side of the Shandong Peninsula are adjacent to the Shengli oilfields. The Jiangsu coastal salt fields on the south side of this Peninsula, which produced about 2 million tons of salt in 1979, are in an offshore area where oil prospects are also good. The good saltfields down south are in the Guangdong Province, Hainan Island bay areas. Many large rock salt deposits undoubtedly will be found in the future, such as the newly discovered Jinggangshan rock salt deposit in Kiangsi Province.

Recognizing the potential need for industrial salts of all kinds, China has started to investigate such resources on land, underground, and in basins and dry lakes. One of the interesting recent discoveries is a large deposit of high-grade natural soda at Nanyang, Dungpo Hsien, Henan Province, within the Paleogene system of Cenozoic rocks.[53] At a mine called Wucheng, a special technique for extracting underground soda deposits was devised, involving a double-concentric-pipe system to reach the soda beds; water is pumped down through the inner pipe, and dissolved soda returns to surface through the outer pipe (somewhat like the Frasch Process for sulfur).

China's production of other kinds of industrial salts has also made significant progress, along with basic investigations as to their origin, availablity, and extraction problems. The Zhinghai (Tsinghai) Salt Lake Institute of the Chinese Academy of Sciences has recently completed a survey of more than 1,000 salt lakes in the Tsinghai-Tibet Plateau, which together represent half the dry, semidry, and salt lakes in the entire country.[54] Two important scientfic books were published on this general subject. One is entitled "The Salt Lakes of the Zhaidam Basin," and provides good scientific guidelines to exploration for new saline sedimentary beds. The second is called "Methods for Analyzing Brine and Salts," and evaluates the chemical and physical properties of the pertinent minerals and elements.

A description of the over-3,000-year-old Yuncheng inland salt field (semidry lake deposit), located in the southwestern part of Shanxi Province, appeared in the press.[55] This salt field is 20 to 30 kilometers long and 3 to 5 kilometers wide. It is a complex salts storehouse, much like Searles Lake in California. Aside from large tonnages of sodium sulfate, sodium chloride (edible salt), magnesium sulfate, and calcium sulfate (gypsum), there are many lesser minerals and elements such as bromine, iodine, potassium (potash), borates, lithium, and many rare elements. Only edible salt was produced in the past, but Yuncheng has now been modernized into a chemical raw material base with sodium sulfate as the foremost product. The degree of mechanization has steadily increased, output has been continually expanded, and a greater variety of products has been manufactured, including dehydrated sodium sulfate, sodium chloride, sodium silicate, and bromides, etc.

China, with arid-climate geology in some areas, probably will someday uncover important tincal and colemanite deposits, if it has not already done so. There is a 40-square-kilometer "borate" lake called Iksaydam, located north of Chaerhan (phonetically similar to Chaka, Chahai, Charkhan, etc.) in the Zhaidam Basin of Zhinghai, and a 100-square-kilometer "potash" dry lake at Chaerhan itself. Both, and others as well, seem to be similar to Searles Lake in California, which produces borates, potash, and other chemicals. A borax plant with "hundreds of furnaces" was reportedly built at Iksaydam over a decade ago. The Chaerhan works has a 2.3-kilometer, double-track railroad built to it to bring out about 100,000 tons per year of various salts. A new process was recently devised to extract carnallite from the Chaerhan Lake based upon the "daily salt separation (crystallization) quota." Another technique for making potassium fertilizer was similarly developed to increase potash output by twentyfold. Additionally, a method to extract boric acid directly from the borates obtained from Chaerhan's mixed salts, through the use of sulfur dioxide, was introduced. The Chinese claim, generally, extensive resources of lithium and borates in the lakes of Tibet, too. Japan, among other countries, had been importing several thousand tons of chemical borates annually from China. China's fiberglass plants constructed in recent years undoubtedly use some borate as raw materials.

Other Nonmetals.—Important discoveries were recently made of bentonite, kyanite, and phosphate rock.[55] In fact, 10 million tons of high-grade sodium bentonite was uncovered in the Lin-an District west of Hangzhou in Zhejiang Province. Another large deposit was reported for Tuokehshun in Sinkiang with no specifics. Bentonite is used as a heat-resistant lubricant, as a refractory material, and in oil drilling. Kyanite was said to have been discovered in Shanxi and Hebei Provinces. Kyanite is another high-temperature refractory material, used in making pottery and porcelain and in steelmaking. In fact, some of the kyanite is destined to be used by the ultramodern Shanghai Baoshan Steelworks now being constructed. In the process of discovering and developing the Fuchan phosphate mine in Kweichow Province, high values of iodine were found to be embedded in the phosphate ore.

Lithium deposits, believed by the Chinese to be the biggest in the world, have been found in the salt lakes on the Tibetan Plateau.[56] The Zhinghai Lake Research Institute in surveying northern Tibet and Ngari District reports that extensive resources of sodium, potassium, boron, lithium, bromine, rubidium, cesium, and radioactive elements are present in the salt lakes, with particularly plentiful amounts of lithium and boron. Large quantities of borates reportedly lie exposed on the surface within beds several meters thick.

The previously mentioned new mineral belt extending over 550,000 square kilometers through the Yunnan-Tibet-Sichuan-Zhinghai border areas is not only rich in metal prospects but also has promising deposits of nonmetallics as well, such as troilite, potash, mica, asbestos, gypsum, arsenic, magnesite, and limestone. A 90-million-ton gypsum deposit was recently discovered in Sihui County, in southeastern Guandong Province, and mine development is already underway. Fukien, as well as other southern Provinces, is said to have large deposits of pyrophyllite which can be made into good refractory firebricks for use in steelmaking; in fact, the Ministry of Metallurgy is helping Fukien authorities to make refractories. Various groups are working on or doing research in refractories at, for example, Loyang and Tieanjin. The Shanghai Silicate Institute of the Academy of Sciences is said to have succeeded in making synthetic mica of good quality.[57] An important zeolite deposit has been noted for Lishui County, Zhejiang Province; additional deposits might be found in other counties of this Province, such as Chunhua, Ningbo, and Taichou. Zeolite is used in absorption and catalytic processes, and therefore important industrially.

MINERAL FUELS

Coal.—For the first time, the State Statistical Bureau of China officially reported China's coal output—550 million metric tons for 1977 and 618 million tons in 1978. Output in 1979 was said to be 628 million tons (preliminary). All these figures would be the marketable tonnage, the average heating value of which might be 10% to 15% lower than the mean of U.S. coals. China is one of the big three world producers of coal, roughly on a par with the United States and the Soviet Union. Chinese production consists almost entirely of hard coals, including 25 to 30 million tons per year of anthracite. The initially announced goal of planners is to top 1 billion tons by about 1987.[58] The Japanese stated that Chinese coal reserves may be on the order of 1,500 billion tons, adequate to support much higher output levels. Other estimates credit China with as much as 10 trillion tons of reserves. A very recent Chinese estimate places total coal reserves at 5 trillion tons, of which 600 billion are recoverable at present.

1979 marked the beginning of China's "coal adjustment program." The goals of the program are to reestablish proper relations between geology and design work and between tunneling and excavation; to assure adequate supplies of machinery and equipment for production to emphasize, miners livelihood and working conditions; to evaluate economic viability of mines and enterprises; and to strengthen coordination between production and transport.

Eight very large coal bases, each with a cluster of mines together producing 20 to 50 million tons per year, are currently being constructed or expanded around the country along with another 40 or so smaller coal bases. According to the Ministry of Coal Industry, China opened 22 coal mines in 1979 aggregating 9.5 million tons per year in combined capacity. In addition, 10 existing mines were enlarged, adding another 4.5 million tons per year.[59] Major coal mine construction projects were reported for the Kailan, Huainan, Huaipei (Huaibei), Tatung (Datung), Yenchou (Yanzhou), Kuchiao (Gujiao), and Huolinho coalfields. For existing mines, greater mechanization will be introduced whenever possible, using both Chinese and foreign equipment. Chinese coal seams are generally deep, which explains why so little strip mining has been done. However, considerable interest in strip mining was shown by the coal mining delegation that toured the United States in the fall of 1978 and by the Chinese who hosted several U.S. coal delegations. During 1979, the Chinese were trying to get help to develop the Yimin open-cut coal mine in Heilongjiang Province into a 20-million-ton-per-year operation and, as noted, had already started work on the Holinho lignite coalfields in Jilin Province.

The predominant proportion of Chinese coal is produced in the eastern third of the country, where the population is also concentrated and where known reserves are primarily located. About half of China's 1978 coal output came from northern China, headed provincially by Shanxi with roughly 95 million tons, Shandong with 50 million tons, Henan with 45 million tons, Hebei with 40 million tons, and Inner Mongolia, Shanxi, Gansu, and the former Ninghsia, each with 8 to 12 million tons.

In northeast China, Liaoning produced about 60 million tons; Heilongjiang, 40 million; and Jilin, nearly 20 million. Anhui produced over 25 million; Yunnan and Sichuan, 20 to 30 million each; Jiangxi, Guangdong, and Hunan, 15 million each; Guizhou, 11 million; and Jiangsu, 8 million tons. The gain in 1979 was across the board but with sharper increases in Shanxi and Shandong Provinces particularly. Surveying and basic construction have been accelerated in previously coal-short southern China or Chiangnan (Yangtze River and south). China has a total of over 20,000 small mines that together furnish about one-third of the national output.

Hitherto, almost all the coal mines have been developed by the Chinese themselves; however, the effort to buy foreign equipment and seek specific outside help has been accelerated. West German firms (Krupp, Orenstein & Koppel, Demag, Thyssen, GHH, Ruhrkohle, and Wesshuette) signed a DM8 billion protocol to help develop five deep-shaft hard coal mines of roughly 4 million tons per year each and expand a sixth one from 3 to 6 million tons per year; all of these mines are within the Kailan coalfields of Hebei Province and the Huainan, Huaipei, and Linhuan (Leonwei) coalfields of Anhui Province. Some of the coal developed will be exported to Germany. In addition, the Germans are to develop the 2-billion-ton Huolinho lignite deposit in Jilin Province, northeast China, into a 20-million-ton-per-year operation.

The British National Coal Board, together with Powekll Duffryin, was asked to help build two new major coal mines in Tatung, Shanxi. Part of the future output is slated to fuel a new powerplant to be constructed in Hong Kong. Late in 1978, the Japanese were asked to help develop two steam coal mines, one within the Yanzhou (Yenchou) coalfields of Shandong and the other within the Kuchiao (Gujiao) coalfied of Shanxi; the coal will be shipped as payment for investments. The Chinese were looking into other arrangements with the Japanese in Hebei, Henan, and Liaoning Provinces. The two countries have discussed coal beneficiation facilities also. The Chinese coal industry is increasingly interested in U.S. surface mining equipment. The Poles are selling some coal equipment to China. The French sold longwall coal cutting machines to China, and the British, retrievable supports.

Most Chinese coal mines have some kind of upgrading or beneficiation facilities, although few have sophisticated plants. One might guess that up to 150-200 million tons per year of Chinese coals extracted represents the mechanically cleaned variety. However, the Chinese are getting very interested in coal preparation, witnessed by equipment purchases from the West and invitation of several of the best known U.S. specialists in this line to visit China. Reportedly, cleaned coal has increased one-third in 1978 compared with 1977. There has been keen competition among coal combines and mines to improve coal quality; around the end of 1978, a national meeting on this subject was called in Tsaochuang, Shandong Province, to evaluate recent performance.

In line with better utilization, mass efforts were being made to use coal middlings, low-grade coals, coal shales, and even tailings as fuels or raw materials to produce building materials, chemicals, (such as alum and aluminum chloride), and rare metals. China apparently has over 100 billion tons of easily minable bituminous coal shales scattered mostly in southern China. In Hebei Province alone, about 5 million tons per year of intermediate grades are being utilized, which is equivalent to over 1 million tons per year of clean coal in heating value (the practice is to mix 10% to 20% of this in boiler use), plus raw material for cement, refractories, and chemicals. Two other important coal-producing Provinces, Liaoning and Shanxi, are also utilizing such raw materials on an increasing scale. In 1979, Zhejiang Province used about 3 million tons of bituminous shale of 1,000-2,000 kilocalories in fluidized bed boilers.

Kailan (Kailuan) Combine's seven underground mines were fully rehabilitated by early 1978 so that capacity was brought back to 25 million tons per year of raw coal or more than 20 million tons of dressed coal. Roughly 370 kilometers of roadways was restored, along with all the shafts. The Tangshan coal dressing plant was totally rebuilt, and hydraulic mining was resumed at the Luchiato mine. In 1978, an 8-year plan was drawn up to transform Kailan into one of the world's most modern operations. Another plan was drawn up for the complete restoration by 1982 of Tangshan City, which is located in the center of the Kailan enterprise and which was nearly totally demolished by earthquake damage in 1977.

Shanxi, China's leading coal-producing Province, produced at least 95 million tons of coal in 1979; projects already initiated could bring output in Shanxi to the 150-million-ton level by the late 1980's. The Tatung (Datung) Combine, with 13 collieries, may be producing close to 25 million tons per year of low-ash, low-sulfur, and high-heating-value bituminous coal (including coking coal). Tatung's new 5-million-ton-per-year Yentzushan mine was being developed in 1978. Shanxi's No. 2 combine, Yanchuan, produces up to 15 million tons per year of anthracite and constitutes one of China's two major anthracite-producing areas. Many westerners have visited these two combines. Shanxi Province also has small mines, which together produce upwards of 30 million tons of coal yearly at the present time. Additionally, the Chinese are interested in building a 20-million-ton-per-year surface combine at Antaipao in Shanxi Province.

The Pingtingshan (Pingdingshan) Combine in Henan Province, with its famous coking coal, reportedly led all Chinese coal combines in surpassing targets.[66] During the first 10 months of 1978, the output goal of this combine was reportedly exceeded by more than 1.8 million tons. For each 10,000 tons of coal produced, the combine's timber consumption was reduced to 80 cubic meters, and its "loss rate" for metal props was lowered to 0.17%. Pingtingshan has 13 collieries, 3 shaft-sinking locations, and about 75 coal-producing teams. Pingtinshan's capacity probably was in the range of 12 to 14 million tons per year as of early 1979.

Huainan, the oldest of Anhui Province's large combines with about 11 collieries, may have pushed production up to 11 million tons per year by 1978. The newer Huaipei combine is a little bigger and still expanding. The third large coalfield in Anhui, called Linhuan (Leonwei), said to have several times the reserves of Huaipei, was under development. Very likely, the West Germans will be involved with Huaipei and Linhuan. The Fengfeng and Tungfeng combines in Hebei Province and the Wumeng complex in Guizhou (coking coal) apparently topped the 10-million-ton-per-year level for the first time. Another combine to the south, Hsuchow (Xuzhou), within Jiangxi Province, has undergone great expansion and may have produced 12 million tons in 1978. Nothing spectacular happened to the two major coal combines in Liaoning Province, Fushun, rated at about 12 million tons per year, and Fushin (Fuxin), which produces over 15 million tons per year; in fact, production from these combines may have started to decline. Heilongjiang Province's pair of roughly 13- to 15-million-ton-per-year combines, called Hokang (Hegang) and Chihsi (Jixi), produced at capacity during 1978 and 1979. The above review shows that China now has more than a dozen combines of 10 million tons per year or greater. China also has approximately about 20 identifiable coal combines of 3- to 8-million-ton-per-year capacity.

Petroleum and Natural Gas.—China surpassed the 100-million-ton-per-year (or 2-million-barrel-per-day) level for the second year in a row, but the announced output gain in 1979 was only 1.9% over 1978. The Chinese talk about trying to develop 10 to 15 "Tachings" within the next two decades. During 1979, China's premium oilfield, Taching (Daqing), and the No. 2 field, Shengli (Xengli), did passably well. However, Takang (Dagang), the No. 3 oilfield that was damaged by the mid-1976 earthquake, was still struggling to resume its normal expansion schedule. The Panshan oilfield between Chinchow (Jinzhou) and Yingkou was being developed into an important chemical raw material base. The new Renchiu or Huabei (means Northern China) field may soon be surpassing Takang and Panshan in importance, in view of the many high-yield wells reported. In Xinjiang, the Karamai field upped production somewhat; possibly more important, however, is that an extensive new field has been discovered in western Xinjiang. Qaidam Basin of Qinghai also holds the promise of large production. A very significant oilfield was being developed in southern China near Samsui close to Guangzhou (Canton).

China's oil output is about one-fourth the U.S. level, but prospects of greatly expanded production are excellent. There is growing evidence that China's crude oil output will top 150 million tons by the early 1980's and over 200 million tons after the mid-1980's. Overall reserve estimates are getting higher as more new fields are mentioned in the press. Secretary Schlesinger of the U.S. Department of Energy, after visiting China in 1978, placed reserves there at 100 billion barrels (7.4 barrels equal 1 ton), conservatively compared with what the Chinese think themselves. China's oil industry is clearly on the rise, with additional reserves found in existing oilfields, intensive drilling done to prove up new fields, and determination that much more unexplored sedimentaries hold promise for fossil fuels. At Taching, there are reports of improved technology, new finds, and additional production horizons. At Shengli, the slogan is to catch up with Taching (possibly 50 million tons per year) in 3 to 5 years. The Jenchiu or (Renchiu) field, proved up only a few years ago, holds such promise that large exports are planned to be made therefrom. Xinjiang's new Kashgar-Agsu field apparently has Soviet-type light oils. The oil- and gas-bearing Tsaidam (Qaidam) inland basin reportedly is as large as England, with extensive coalfields and saline deposits as well. The Ordos Basin, just south of Mongolia, may be another of China's major oilfields of the future. Offshore developments are occuring at a rapid pace.

The Chinese feel that the United States has the best technology on offshore oil. At least nine U.S. companies visited China during 1978 to discuss development of offshore and nearshore oil, particularly in the South China Sea. These are the Pennzoil Co., Exxon Corp., Union Oil Co. of California, Standard Oil Co. (Indiana), Phillips Petroleum Co., Mobil Oil Corp., Atlantic Richfield, Caltex Petroleum Corp., and Natomas Co. The national oil companies of the United Kingdom and France, Royal Dutch Shell, and Italian and Norwegian oil officials have also held preliminary discussions with the Chinese. In 1979, most of these companies were granted seismic survey rights to search for oil offshore.[41] Prospecting and development work in Pohai (Bohai) Bay went mostly to the Japanese, who negotiated the concept that China will bear some of the exploration risk. The Japanese would initially finance the projects, with the Chinese paying their share with future oil. Actually, the Japanese have great respect for Chinese knowledge of continental-origin oil deposits and feel that the offshore areas of Pohai could yield a minimum of 30 million tons per year of oil. The Japanese will also work in the Pearl River Delta onshore and offshore near Canton. Most Asian analysts and oil specialists feel that China's offshore reserves can eventually support annual production of more than 100 million tons of oil.

Chinese exports of oil in 1978 reached perhaps just over 12 million tons, valued at $1 billion plus. Exports in 1979 were nearly the same, but prices were considerably higher. Japan continued to be the primary market, receving roughly 7 million tons of crude oil in 1978. Shipments to North Korea were at most 1.5 million tons (capacity of pipeline) during 1978, with the Koreans paying low prices for Chinese oil from Taching. Shipments to the Philippines, mainly from Shengli, were perhaps 1 million tons in 1978; future contracts indicate 1.2 million tons per year of crude, basically in exchange for copper concentrates. Hong Kong received about 900,000 tons of oil products from China in 1977 and possibly 20% more in 1978. Thailand had been importing about 0.5 million tons per year but signed a 5-year contract on January 14, 1979, to obtain up to 1 million tons per year of Chinese crude oil. Romania has a barter agreement to acquire roughly 0.5 million tons per year in exchange for Romanian fertilizers. Brazil has entered the picture by agreeing to take about 1 million tons of crude oil in 1979 and 1.5 million tons in 1980 in exchange for iron ore and secondarily, pig iron. The Chinese hope to sell much more oil in the long term, to help pay for their industrialization and modernization programs.

The Taching oilfield, between Anta and Fuyu in Heilongjiang Province, has been by far China's biggest. Like most producing fields in China, its oil is high in wax, low in sulfur, and continental in origin. Taching's production has reached about 50 million tons per year of crude oil, possibly close to its potential peak. Recent efforts have been directed toward finding more reservoirs around the fringes and looking for oil at depths exceeding 3,000 meters. Most oil now comes from depths of less than 1,500 meters, but reserves in deeper horizons may be as large as those in shallow formations. Oil recovery is presently about 30%, compared with future hopes of 50% or greater. Taching has facilities to refine 10% to 15% of the crude produced, plus two large fertilizer plants and petrochemical units. Technology is stressed, as witnessed by the 450-member Oil Extraction Research Institute attached to the oilfield. Reportedly, reservoir pressures have been steady, most wells maintain natural flows (95% of the original wells are still utilized), production levels have not declined even for old wells, and the early water injection technique is an unqualified success.

Shengli, comprised of more than 20 smaller oilfields in the Yellow River Delta, covers 10,000 square kilometers. It was far more faulting than Taching, although not as much as Takang. The many faults have cut up the reservoirs and caused mixing of water, oil, and gas. Nonetheless, reserve and operational problems have been overcome, and the hope is to double production from the present roughly 25-million-ton-per-year level in 5 years. As of early 1979, Shengli had about 100,000 workers, up to 200 operating rigs, and some 6,000 individual producing wells. Three medium to poorly consolidated sands, lying mostly between 1,100 to 1,700 meters but reaching twice that depth near fault blocks, provide most of the production.[62] The deepest well was about 5,000 meters. Shengli has a refining capacity of about 6 million tons per year, two fertilizer plants, downstream plants, a petroleum institute, and many kinds of basic industries nearby. A new oil industry complex was being built 80 kilometers to the west. A major network of pipelines passing through Tzupo coal mines and the port of Qingdao has now been extended all the way to Nanking (Nanjing), 1,000 kilometers away. Shengli oil already goes to Japan, the Philippines, the Maoming refinery north of Canton, and many other markets.

The true potential of the Takang (Dagang) oilfield, located nearshore Pohai Bay about 60 kilometers southeast of Tianjin, has not been further clarified. It has been compared with Taching and Shengli, but production definitely is much lower, and structures, much more faulted and folded. Takang's past peak output may have been 10 million tons per year, and some believe it is much lower. However, Takang apparently has good reserves of gas, which have already been piped to Peking and Tianjin. Recent visitors say that Takang has about 60 drilling rigs and 80 production stations working in the "salt flat," and several offshore rigs in Pohai Bay. The Panshan field to the northeast and near the south of the Liao River was said to be not only rich in oil but also in natural gas, sea salt, and boron and magnesium salts.[63] The Liao River area has a large fertilizer plant capable of producing 300,000 tons per year of ammonia and 480,000 tons of urea. A new plastics plant is being built in nearby Yingkou. Panshan's crude oil output may have been somewhat stabilized at the 6- to 8-million-ton-per-year level.

In 3 years, since drilling began in 1975, the Huabei oilfield centered in Jenchiu County south of Peking, has already been developed into an oilfield capable of supporting the needs of the Peking Tungfanghung refinery, which is rated at close to 7 million tons per year. The Huabei field has more than 10 high-yield wells producing in excess of 1,000 tons per day each, and this is just the beginning. Specifically, the No. 11 well reportedly produced 2.6 million tons of crude during the 2 1/2 years of its existence.[64] The No. 4 well, located in the Guchienshan area, was said to be of great geological significanc, because oil occurs in carbonaceous formations of the Sinian in the Paleozoic era, rather than in later rocks such as the Mesozoic and Cenozoic. Such formations are found widely elsewhere, including Jiangsu and Zhejiang Provinces and many other areas along the Yangtze River. Indeed, the brand new Subei field in southern Shandong and northern Jiangsu may be of this nature. Huabei employs early water injection and acidification of oil-bearing formations. Two large pipelines, totaling 200 kilometers, and two large pumping stations were quickly installed. Overall output has risen sharply, with targets overfulfilled. Also, new reservoirs have been discovered around the perimeters. The Luning Pipeline, connecting Shengli and Huapei oilfields with Nanking and elsewhere and to the south, was recently completed. Technically, the oil is more like that of Taching than that of Shengli but with higher sulfur, water, and nitrogen contents, according to the Japanese.

Xinjiang's Karamai oilfield in western Dzungarian Basin may be producing about 7 million tons per year crude. Its downstream facilities have been streamlined somewhat, and a new refinery has been built at Urumchi. A railroad that would eventually link southwest Sinkiang via Urumchi to China's east coast was started. Recent discovery of a large oilfield in the western edge of the Tarim Basin (Takla Makan), between Kashgar and Aksu, led to the decision to build this railroad through the desert. High-grade coals have also been found in large quantities, along with a "sea of oil" and iron, copper, and lead.[65] The southern Xinjiang field is expected to top Karamai's output by far and become one of China's future Tachings. Moreover, the oil is light, nonwaxy, and "conventional." In 1979, negotiations were apparently underway among China and Japanese and U.S. firms to develop jointly this oilfield at an initial cost estimated at $1 billion. There are great difficulties in developing such an oilfield 3,000 miles inland.

China has investigated onshore and nearshore areas of Guangdong Province for oil, with considerable initial success. One major find is the Samsui Basin in the Pearl River estuary near Canton, which may extend all the way to the sea. A recent report states that preliminary investigations had been completed for the Samsui Basin, three successful oil and gas wells had been drilled, and oil flows were seen in two additional areas.[66] The Japanese visited Samsui in mid-1978 and indicated that the oil was high-quality, light crude of 32.5°C pour point, 39% lighter fraction, 0.05% sulfur, 0.04% nitrogen content, and 43% API gravity. Significant deposits of oil have also been found on the Leichow (Liuchow) Peninsula, the Chiungchow Straits north of Hainan Island, and offshore southwest of Hainan in the Tonkin Bay. Reportedly, Guangdong Province will be greatly industrialized by 1985 to include a large oilfield in the South China Seas area, two petrochemical bases, one chemical mineral raw material base, six coal bases, six or seven medium to large powerplants, two medium-size steelworks, three iron ore bases, one nonferrous metal base, two shipbuilding bases, and four rail lines.[67]

China's natural gas production continues to move up sharply, in 1978 registering about a 10% increase over that of 1977, compared with a growth of 22% a year earlier. There is some question as to the production level of natural gas in China. However, output in 1979 may have surpassed 100 billion cubic meters, possibly one-fifth of U.S. production and one-fourth of Soviet production. Sichuan Province is to gas as Taching is to oil, and its gas output has risen more than sixfold in the last 15 years. Gas is widespread in the Province, which is crisscrossed by over 1,000 kilometers of pipelines and split into five natural gas districts with hundreds of gas-oil structures. Luchow (Luzhou) in southern Sichuan, with hundreds of wells and over 300 kilometers of pipelines connecting markets, is one of the best gasfields. One of the better wells here has produced 1.6 million cubic meters per day. Most Sichuan wells are more than 4,000 meters deep, with the deepest at over 7,000 meters, and are reportedly drilled with artificial diamond bits produced in China. Most of Sichuan's basic industries, like fertilizers, steel, power, salt, and cement, are run by gas. Chengdu even uses gas for fueling some buses that are equipped with gas bags on top. This gas is also sent to southeast China via pipeline.

Natural gas is also plentiful in the Tsaidam (Qaidam) Basin, which, however, does not have much in the way of local markets. The Takang oilfield has much natural gas, which already goes to Peking and Tianjin. Efforts to sell liquefied natural gas (LNG) from Takang to Japan have not been successful as yet. Petroleum gas and natural gas are also associated with many other oilfields around the country. Liaoning Province has done well in developing and utilizing natural gas, with output brought up to 1.5 billion cubic meters per annum, or 40 times the 1970 level. Origin of this gas might be the Panshan-Yinkou field. The gas is important in furnishing raw material for the 15 fertilizer plants of various sizes in the Province.

Oil Shale.—Maoming (Mowming) in Guangdong, with China's largest oil shale operation, expanded its general industrial facilities. Natural oil and gas have been found about 200 kilometers to the northeast and 100 kilometers to the southwest, and construction has begun on a railroad between the new Samsui oilfield and Maoming. The 140-kilometer pipeline connecting Changjiang brings in oil from distant places like Shengli and Iran. Maoming's regular oil refinery, rated at 5 million tons per year, is scheduled to be doubled in capacity by 1985. The lubricants plant is most modern, and there is the waste oil recovery plant. Maoming's oil shale operation, with six retorts and 1.5- to 2-million-ton-per-year capacity, may be working at a reduced scale. However, byproducts such as cement and rare minerals and metals are still produced. Maoming's technical personnel have also participated in oil development activities in the South China Seas. China's second largest and older oil shale operation, Fushun in Liaoning Province, seems to be phasing out because of the large quantities of natural oil brought in to support the conventional refinery. Fushun's famous open-cut operations are literally going underground, making the oil shale sitting on top of the coal increasingly difficult to extract. Output of shale oil from

Fushun in 1978 and 1979 probably dropped below 0.5 million tons, which is less than one-third the original capacity.

China is accelerating its efforts to build pipelines, ports, and vessels to ship oil and gas. There are nearly 7,000 kilometers of trunk pipelines at present (excluding local gas lines in Sichuan and elsewhere). China produces mostly 20- to 30-centimeter-diameter welded pipes and imports mainly 61-centimeter pipes. The need for seamless pipes is so great that the Chinese are considering investing in pipemaking facilities in Japan. The newest major pipeline connects the Shengli and Huabei oilfields with Nanking, 1,000 kilometers to the south. Previously, Taching had already been connected with Chinhuangdao and Peking via Tiehling, and separately to Dalien (Luda) and North Korea. Plans are being made to build a big depot in Dalien to facilitate exports. Another long pipeline is from Sichuan to the east coast. A 1,000-kilometer pipeline extends from Koerhmu to Lhasa at the southeastern tip of the Tsaidam Basin. A short (140-kilometer) but important pipeline has been built from Chanjiang to Maoming in Guangdong.

China's oil refinery and petrochemical facilities were being expanded at a pace commensurate with the increase in crude production less exports and direct domestic consumption of crude. All indications are that the country's oil-refining capacity may be as much as 90 million tons per year as of early 1979. The Chinese reported that as of the fall of 1978, national oil-refining capacity had increased nearly 400% in a decade, which means that the increment is likely to be in excess of 60 million tons per year.[66] They also report that 57.5% of the increase came from buildup of old refineries and that this buildup is equivalent to adding over 12 refineries of 2 to 3 million tons per year each. Innovations have also helped to improve product quality and variety. China's old refineries are basically of two types—an "ESSO" type of about 2.5 million tons per year and a Soviet type of up to 2 million tons per year; one or more of these basic units can be constructed wherever necessary. The Chinese claim that their high-wax crudes are good as raw materials for cracking.

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[1] See also chapter on Taiwan.

[2] Formerly supervisory physical scientist, Branch of Foreign Data.

[3] The unit of Chinese currency is Yuan or Ren-Min-Bi (RMB). The nominal exchange rate was about RMB1.7 = US$1.00 in early 1978, RMB1.6 = US$1.00 in late 1978, and RMB1.5 = US$1.00 in late 1979.

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[14] Takungpao (Hong Kong). Nov. 4, 1977, p. 1.

[15] Takungpao (Hong Kong). Oct. 22, 1978, p. 3.

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[18] The China Business Review (Washington, D.C.). September-October, 1978, p. 69.

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[21] Takungpao (Hong Kong). July 24, 1978, p. 1.

[22] New China News Agency (Peking). Dec. 7, 1978.

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The Mineral Industry of Colombia

By Orlando Martino[1]

Colombia's economic recovery gained impetus in 1978 and 1979 relative to the recession of 1975. The gross domestic product (GDP), estimated at $21.3 billion[2] at current prices, grew in real terms by 8% in 1978, compared with the 6% growth rate in 1977, while the rate of inflation was reduced to 18%. Preliminary data indicate that the economy grew by 6% in 1979, but the inflation rate increased to 28%.

The mineral industry of Colombia was dominated by the production of crude petroleum, natural gas, and coal. Except for iron ore, gold, and platinum, the production of metallic minerals was limited. Colombia continued as a major gold producer in Latin America and as a significant world producer. Among nonmetallics, Colombia was the world's leading producer of emeralds and a significant Latin American producer of salt and cement.

During 1978 and 1979 Colombia proceeded with programs to exploit its potential in petroleum, natural gas, coal, and nickel. The Empresa Colombiana de Petróleos (ECOPETROL) entered into additional association contracts with foreign companies for oil exploration and increased its own drilling program. Work progressed on the feasibility study for the El Cerrejón coal deposit, and negotiations were completed on financing for the Cerro Matoso nickel project. There was also some progress on initial steps to develop Colombia's new discoveries of copper and phosphate rock deposits. Uranium exploration activities progressed satisfactorily. The Ministry of Mines and Energy announced the discovery of a significant deposit of bauxite in Arauca in 1978.

In April 1979, Colombia was granted a $600 million loan from a consortium of foreign banks led by the Chemical Bank of New York. Of this amount $200 million would be allocated to ECOPETROL for capital investments in oil refining, development, and exploration.

In August 1978 President Julio Cesar Turbay took office and by yearend had made no drastic change in economic policy. Emphasis continued on curbing inflation and promoting regional economic decentralization. As a member of the Andean Pact, Colombia was not actively seeking foreign investments in most sectors of the economy, particularly in commerce and finance. However, a favorable investment climate existed for potential investors in mining, petroleum, and export industries.

According to the U.S. Bureau of the Census, U.S. direct foreign investment in Colombia increased from $653 million in 1976 to $706 million in 1977, the first substantial increase since formation of the Andean Pact. U.S. investment in petroleum in the same period increased from $56 million to $71 million. The increase in petroleum activities was stimulated by the Government decision in 1976 to change its petroleum pricing policy for new and incremental crude oil production.

Decree Law No. 1620 of 1978 was promulgated, the second important reform introduced in the Mining Law - Decree 1275 of 1970. The first reform appeared in Decree 2181 of 1972. The 1978 reform simplifies the procedures for requesting a license for exploration and obtaining a concession and expedites the release of the zone covered by the license. Another important change specifies that a right of way cannot be exercised until the miner pays the corresponding indemnification to the private property owners.

Table 1.—Colombia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Chromite, gross weight	5,000	5,000	5,000	5,500
Copper, mine output, metal content	--	900	500	500
Gold troy ounces	[r]300,307	263,437	257,632	290,000
Iron and steel:				
Iron ore and concentrate thousand tons	498	460	454	475
Pig iron do	286	223	297	245
Ferroalloys: Ferrosilicon[e]	1,200	1,200	1,200	1,200
Crude steel thousand tons	356	330	391	365
Semimanufactures, hot-rolled do	300	294	329	330
Lead, mine output, metal content	126	126	120	120
Manganese ore, gross weight	[e]6,000	[e]6,000	[2]24,000	[2]24,000
Platinum-group metals troy ounces	16,779	17,300	13,939	15,000
Silver do	[r]106,812	91,420	83,354	100,000
Zinc, mine output, metal content	60	--	--	--
NONMETALS				
Asbestos	[e]5,000	--	NA	NA
Barite	3,500	[e]3,450	3,500	3,600
Cement, hydraulic thousand tons	3,622	3,298	4,153	4,740
Clays:				
Bentonite[e]	1,200	1,200	1,200	1,200
Kaolin	[e]110,000	788,000	783,000	795,000
Diatomite	650	630	630	635
Feldspar	35,000	26,508	26,455	27,200
Gypsum thousand tons	[r]205	210	255	272
Lime, hydrated and quicklime[e] do	[r]1,000	1,300	1,300	1,300
Magnesite	1,732	1,770	1,400	1,400
Mica	23	45	NA	NA
Nitrogen: N content of ammonia	90,400	65,100	63,600	90,000
Phosphate rock	13,500	8,100	4,900	6,000
Precious and semiprecious stones: Emerald:				
Gem stones carats	NA	60,575	NA	NA
Moralla do	NA	[3]423,937	NA	NA
Total[4] do	499,802	484,512	500,000	550,000
Salt:				
Rock thousand tons	[r]186	181	178	172
Other do	925	741	573	572
Total do	[r]1,111	922	751	744
Sodium compounds: Sodium carbonate	149,374	140,588	167,172	140,000
Stone and sand:				
Calcite	[r]7,800	8,280	8,500	8,500
Dolomite thousand tons	[r]23	22	52	50
Limestone do	[r]7,800	8,112	9,431	10,000
Marble cubic meters	[r]35,500	38,292	41,224	40,000
Sand, not metal bearing	[r]860,000	840,000	820,000	850,000
Sulfur:				
Native (from ore)	[r]24,000	22,000	18,000	20,000
Byproduct, from petroleum	2,000	2,000	3,000	3,000
Total	[r]26,000	24,000	21,000	23,000
Talc, soapstone, pyrophyllite	[r]1,000	[e]1,150	1,320	1,270
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	[e]26,300	4,200	NA	NA
Coal, all grades thousand tons	4,000	4,204	4,930	5,000
Coke, all types do	400	500	530	500
Gas, natural:				
Gross million cubic feet	117,924	122,325	127,000	130,000
Marketed do	66,715	74,217	76,000	NA
Natural gas liquids:				
Propane thousand 42-gallon barrels	3,041	[e]2,645	[e]2,700	NA
Butane do	666	582	600	NA
Natural gasoline do	1,094	700	700	NA
Condensate do	398	373	400	NA
Total do	5,199	4,300	4,400	NA
Petroleum:				
Crude do	53,376	50,222	47,742	45,400

See footnotes at end of table.

Table 1.—Colombia: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978^{p}	1979^{e}
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products:				
Gasoline:				
Aviation -------- thousand 42-gallon barrels--	360	373	374	400
Motor ---------------------- do----	^{r}21,357	23,236	18,348	16,500
Jet fuel ---------------------- do----	^{r}2,729	2,895	3,150	3,600
Kerosine ---------------------- do----	^{r}3,302	3,156	3,067	3,200
Distillate fuel oil ---------------------- do----	^{r}7,583	7,505	7,961	7,800
Residual fuel oil ---------------------- do----	^{r}18,321	18,420	18,947	15,700
Lubricants ---------------------- do----	389	351	333	400
Other:				
Liquefied petroleum gas -------------- do----	2,100	1,992	1,819	1,600
Asphalt and bitumen -------------- do----	^{r}566	458	598	700
Refinery fuel and losses and unspecified products do----	^{r}2,427	1,978	2,855	9,400
Total ---------------------- do----	59,084	60,364	57,452	59,300

^{e}Estimate. ^{p}Preliminary. ^{r}Revised. NA Not available.

[1] In addition to the commodities listed, coal briquets are also produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[2] Data may not be comparable to those given for prior years because of a change in methodology for gathering production statistics that was initiated by the Ministry of Mines and Energy in 1979 and which affected data collected on 1978 output.

[3] U.S. imports, largely moralla and gangue but also including some gem-quality emerald.

[4] Data represent total Colombian exports.

PRODUCTION

Colombia's limited production of commodities is given in table 1. Output of iron ore declined slightly. However, steel output increased significantly but was below the peak year of 1972 and then declined in 1979. As for precious metals, in 1978 there was a slight decline in gold production, and a significant drop in output of silver and platinum.

Among nonmetallics, cement production rebounded to a historic high in 1978 and 1979. Output of rock and marine salt declined. Of the mineral fuels, production of coal and natural gas increased to new highs in 1978 and 1979, while output of crude petroleum continued its downward trend.

TRADE

Expansion of Colombia's international trade continued in 1978 and 1979. However, mineral and mineral-related commodities remained a small part of overall trade, which continued to be dominated by coffee exports. In late 1979 the Director of Colombia's fund for the Promotion of Exports (PROEXPO) announced that during the next 5 years special emphasis would be given to exports from the mining sector within Colombia's long-term policy of export diversification.

According to figures of the Banco de la Republica for 1978, Colombia's trade deficit widened to $471 million: while total registered exports increased 27% to $2.94 billion, registered imports increased 28% to $3.41 billion.

For the yearly data available, Colombia's limited mineral exports are shown in table 2, and the mineral imports in table 3. The leading mineral export in 1978 was fuel oil valued at $127 million, followed by emeralds at $40.7 million, portland cement at $38.3 million, mineral ores at $11.1 million, and platinum at $2.5 million. The value of platinum exports rose sharply in 1978 by almost 200% owing primarily to increases in world prices.

Imports of crude oil declined slightly to 24,200 barrels per day because of price increases. The total value of crude oil and refined products imported in 1978 reached $243 million, some 30% above 1977. Colombia continued to rely on imports to meet its demand for certain steel products and nonferrous metals, especially aluminum, copper, lead, and zinc.

As part of its international trade policy, Colombia's adherence to the General Agreement on Tariff and Trade (GATT) was announced on December 21, 1979, by the Director of the Instituto Colombiana de Comercio Exterior (INCOMEX).

On January 31, 1979, the Minister of Mines and Energy issued Resolution No. 00088 on the requirements that must be complied with in order to obtain customs duty exemption on imports brought into Colombia specifically for the mining industry.

Table 2.—Colombia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976
METALS	
Aluminum metal including alloys, all forms	364
Chromium ore and concentrate	3,807
Copper:	
Ore and concentrate	1,780
Metal including alloys, unwrought and semimanufactures	9
Gold:	
Ore and concentrate thousand troy ounces	13,433
Metal, unworked or partly worked troy ounces	6,559
Iron and steel metal:	
Pig iron, ferroalloys, similar materials	8,802
Steel, primary forms	55
Semimanufactures:	
Bars, rods, angles, shapes, sections	1,280
Universals, plates, sheets	510
Hoop and strip	6
Rails and accessories	1,300
Wire	513
Tubes, pipes, fittings	1,735
Castings and forgings, rough	148
Total	5,492
Lead:	
Ore and concentrate	234
Metal including alloys, all forms	9
Nickel metal including alloys, all forms	1
Platinum-group metals and silver:	
Ores and concentrates thousand troy ounces	13,433
Metals including alloys do	14
Zinc metal including alloys, all forms kilograms	330
Other:	
Ash and residue containing nonferrous metals	116
Base metals including alloys, all forms	1
NONMETALS	
Abrasives, natural (including industrial diamond) kilograms	287
Cement	677,370
Fertilizer materials:	
Manufactured	27,914
Ammonia	5,421
Precious and semiprecious stones kilograms	3
Sodium and potassium compounds: Caustic soda	4,615
Stone, sand and gravel	247
Other, crude	1,557
MINERAL FUELS AND RELATED MATERIALS	
Carbon black	10,160
Coal:	
Anthracite	15,666
Bituminous	3,085
Coke and semicoke	33,896
Petroleum refinery products: Residual fuel oil thousand 42-gallon barrels	8,767

Table 3.-Colombia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976
METALS	
Aluminum metal including alloys, all forms	16,032
Copper metal including alloys, all forms	5,863
Iron and steel:	
Ore and concentrate	397
Metal:	
Scrap	8,815
Pig iron, ferroalloys, similar materials	8,043
Steel, primary forms	13,153
Semimanufactures:	
Bars, rods, angles, shapes, sections	21,731
Universals, plates, sheets	162,096
Hoop and strip	4,715
Rails and accessories	625
Wire	4,064
Tubes, pipes, fittings	53,511
Castings and forgings, rough	67
Total	246,809
Lead:	
Oxides	1,029
Metal including alloys, all forms	2,958
Manganese:	
Ore and concentrate	4,446
Oxides	744
Nickel metal including alloys, all forms	228
Platinum-group metals and silver:	
Ores and concentrates troy ounces	579
Metals including alloys do	27,264
Tin metal including alloys, all forms	324
Titanium oxides	473
Zinc metal including alloys, all forms	11,981
Other:	
Ores and concentrates	3,002
Ash and residue containing nonferrous metals	663
Metals including alloys, all forms, n.e.s	94
NONMETALS	
Abrasives, natural (including industrial diamond)	860
Asbestos	19,954
Clays and clay products (including all refractory brick):	
Crude: Kaolin	3,208
Products, refractory (including nonclay brick)	6,419
Fertilizer materials:	
Manufactured:	
Nitrogenous	23,093
Potassic	16,700
Ammonia	23,035
Pigments, mineral: Iron oxides, processed	727
Sodium and potassium compounds, n.e.s	1,640
Stone, sand and gravel:	
Dolomite, chiefly refractory grade	4,917
Other	21,347
Sulfur, elemental, other than colloidal	24,750
MINERAL FUELS AND RELATED MATERIALS	
Carbon black	681
Coal, coke, peat	65
Gas, hydrocarbon, natural and manufactured kilograms	7,112
Petroleum:	
Crude thousand 42-gallon barrels	6,725
Refinery products:	
Gasoline:	
Aviation do	35
Motor do	2,617
Distillate fuel oil do	40
Lubricants do	20
Other do	11
Total do	2,723

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—The Institute of Geological and Mineral Investigations (INGEOMINAS), a dependency of the Ministry of Mines and Energy, reported proved bauxite reserves of 400 million tons in the Intendencia de Arauca situated northeast of Bogota and south of the Venezuelan border. The bauxite deposit has an average grade of 38% Al_2O_3. The State mining company, Empresa Colombiana de Minas (ECOMINAS), was planning to carry out further studies.

A minerals survey report of the United Nations on Colombia indicated that there are possibilities for Colombia to become one of the largest aluminum producers in Latin America. This industry would be based on Colombia's abundant reserves of coal, caustic soda, and hydroelectric power. Colombia continued to import all its aluminum ingot, principally from Venezuela.

Copper.—ECOMINAS announced in late 1979 that preliminary geological surveys indicate that a large copper deposit has been discovered in an isolated part of the Departments of Chocó and Antioquia. The Los Pantanos-Pegadorcito deposit was estimated to have reserves of 250 to 625 million tons of ore grading 0.7% to 1.2% copper. Colombian officials began talks with Amoco concerning a joint venture. Two other copper deposits were being studied in the same area at Murindo and Monde.

Assays for the newly discovered Alisales copper deposit in the Department of Narino indicate ore grade of 3% copper. Texasgulf Inc. and ECOMINAS were discussing a joint venture for Alisales.

Gold, Platinum, and Silver.—Since 1975, Colombia's gold production has dropped steadily. The 20% increase in gold output projected for 1978 did not materialize. The slight decline was caused by labor problems. Small and medium miners increased their share of total production to 70%. The share of production by the large-scale companies has been droppping since 1965. The Departments of Antioquia and Chocó accounted for about 90% of Colombia's output in 1978. In April 1978, the Junta Monetaria de Colombia made both the domestic and the export price for gold equal to its world price, as part of an international agreement. Since 1972 no gold has been exported.

Platinum and silver output declined significantly. The rebound in output of platinum in 1977 proved to be short lived, and the downtrend since 1973 was resumed.

Iron Ore.—Colombia's total iron ore resources have been estimated at 535 million tons, including reserves of 235 million tons, a third of which has an iron content of about 48%.[9] The balance of the reserves has an iron content ranging from 22% to 32%. The higher grade ore deposits lie near Socha within 30 kilometers of Paz del Rio, site of Colombia's major steel center. Since these iron deposits have a high phosphorus content, the steel plant uses the Thomas Bessemer converter process for steel production instead of the more widely used hearth method.

A smaller iron ore deposit with grades of up to 58% iron content is located in Sopó near Bogota. This deposit supplies a pig-iron producer, Colombiana de Arrabio S.A. (COLAR), with 40,000 tons per year of low-phosphorus pig iron. The output covers needs of local foundries and a surplus for export.

Iron and Steel.—Production of crude steel by Acerias Paz del Rio S.A. (APR), Colombia's major integrated producer and the largest privately held corporation, rebounded from the depressed level of 1977 to 265,200 tons but was below the peak output of 1972. APR accounted for 28% of Colombia's apparent consumption of finished steel products, while Colombia's six semi-integrated steel companies accounted for 17% and imports represented 55%. APR's net profit in 1978 reached a historic high at almost $10 million.

APR proceeded with its project to expand its plant to a capacity of 400,000 tons of steel per year under engineering consultation with Creusot-Loire Entreprises, patent holder of the Loire-Wendel-Sprunck (LWS) system. In November 1978 an agreement was signed with Linde A.G. of Germany for the oxygen plant for injecting oxygen in the blast furnaces. APR's expanded capacity was expected to be available by mid-1980 and would supply higher quality steel. The project also contemplates expanded output of iron ore, coal, and limestone. Colombia has ample reserves of the basic raw materials for steelmaking.

Colombia's six semi-integrated steel plants, using scrap as an essential input, operated at only half of their capacity of 240,000 tons per year of crude steel ingots, owing to shortages in domestic steel scrap and difficulties in transporting imported scrap from ocean ports to the steel plants. Siderúrgica del Pacifico S.A. (SIDELPA) in Cali was the largest semi-integrated producer with a capacity of 60,000 tons of crude steel.

Four semi-integrated steel companies have sponsored a feasibility study for a sponge iron plant to utilize high quality imported iron ore pellets in a direct reduction process. The Caribbean port of Cartagena was being considered as the plant site. The proposed $75 million plant would use natural gas from the Guajira gasfields once the existing gas pipeline from these fields is extended from the port of Barranquilla. The Guajira fields, with proven reserves of 5.5 trillion feet, had a production capacity of 200 million cubic feet per day in 1979. The proposed plant would require only 6% of the current potential yield of the Guajira gasfields.

Nickel.—The joint venture comprising Cerro Matoso S.A., incorporated in March 1979, was restructured to include the Empresa Colombiana de Niquel (ECONIQUEL)- 45%, Compania de Niquel Colombiana (CONICOL) - 20%, and Billington Overseas Ltd. - 35%. ECONIQUEL is a subsidiary of state-owned Instituto de Fomento Industrial (IFI), and CONICOL is a joint venture of the Hanna Mining Co. and Standard Oil of California (SOCAL) which contributed to the discovery of the Cerro Matoso deposit in 1956. Subsequently SOCAL transferred part of its mining rights to IFI and Hanna. Billington, a subsidiary of Royal Dutch Shell, entered into a 12-year contract to buy all the ferronickel produced by Cerro Matoso.

The Cerro Matoso open pit operation to be located near Montelibano, Department of Córdoba, south of Cartagena, will have a crushing plant, a dryer, a smelter (electric furnaces), a natural gas pipeline, a river wharf, and other support facilities to produce 50,000 tons of ferronickel with a nickel content of 37.5%. Construction work was initiated in late 1979, and startup was scheduled for early 1982. The $340 million project will be financed by the original $100 million capitalization of the three partners, a commercial bank consortium led by Chase Manhattan ($120 million), the World Bank, and the U.S. Export-Import Bank (EXIMBANK). A portion of the financing was obtained in November 1978 when EXIMBANK agreed to extend a $25.6 million credit to Cerro Matoso S.A. In October 1979, the World Bank approved its loan of $80 million.

The three areas of mineralization of the Cerro Matoso deposit with proven reserves of 19.5 million dry tons will be exploited in three stages as indicated in table 4. Overall Colombia's lateritic nickel deposits are estimated at 88 million tons of ore, broken down as follows: 25 million tons with a nickel content ranging from 1.5% to 3.2%, some 40 million tons with a nickel content ranging from 1.0% to 1.5%, and marginal deposits of about 23 million tons ranging from 0.5% to 1.0% nickel. The Cerro Matoso deposit, the most important one, is included in these figures.

When full production is reached in 1985 at 60,000 tons per year of ferronickel, exports would yield about $200 million in additional export revenues and assist Colombia's export diversification goals.

Table 4.—Colombia: Cerro Matoso nickel reserves and development stages.

Area	Approximate life (years)	Reserves (dry metric tons in thousands)	Percent				
			Nickel	Iron	SiO_2	MgO	Ignition loss
Stage I	9	7,060	3.20	13.8	47.5	14.8	9.1
Stage II	7	5,252	2.72	13.2	45.9	17.4	9.6
Stage III	9	7,175	2.22	18.8	41.6	12.9	9.6
Total	25	19,487	2.71	15.5	44.9	14.8	9.4

Note: The total ore reserve corresponding to Stage III amounts to 12,655,000 dry tons with an average nickel content of 2.22%. In addition there is a deposit of 41 million dry tons with an average grade of 1.51% nickel.
Source: Ministerio de Minas y Energia. Boletin de Minas y Energia. (Bogotá). V. 2 No. 4, January 1978, p. 31.

NONMETALS

Cement.—Exports of portland cement valued at $38.3 million in 1978 continued to figure significantly among Colombia's total exports. In March 1978 Acerias Paz del Rio signed a $21 million contract with the Japanese firm of Kawasaki-Marubeni for the engineering, equipment, and installation supervision for a cement plant near the Belencito steel plant in Sogamoso. The cement plant will utilize slag from the blast furnaces of the steel plant for an output of 600,000 tons per year of cement and was scheduled for startup in mid-1980.

Fabrica de Cemento Samper was extending its La Calera plant near Bogotá. Cementos del Caribe S.A. in Barranquilla was expanding its wet process plant for operation in 1980.

Emerald.—Exports of about 894,900 carats of emerald increased to $40.7 million in 1978 compared with $6.5 million in 1974. In 1977, Colombia exported 484,500 carats of emerald valued at $27.5 million. The increase reflected the return to stability in the Muzo, Coscuez, and Peñas Blancas mines following a period of violence and disorder in the gemfields owned by the state. The main export markets were the United States, Japan, and the Federal Republic of Germany.

Production continued at the Chivór mine in Almeida, Boyacá, the largest privately owned emerald mine in Colombia. Under 5-year renewable contracts, the Muzo Mine was operated by the Sociedad Minera Boyacense, the Coscuez Mine by Esmeraldas y Minas de Colombia S.A. (ESMERACOL), and Peñas Blancas by Hermanos Quintero Morales-all private companies headquartered in Bogotá.

By Decree Law No. 1411 of July 1978, ECOMINAS, which had operated the state-owned mines from 1970 to 1973, was given control of the domestic and foreign marketing of emerald and other gem stones, a function previously exercised by the Ministry of Mines and Energy.

Fertilizer Materials.-*Phosphate.*— ECOMINAS was evaluating proposals for a feasibility study of a $70 million phosphate mining and fertilizer operation at Pesca in the Department of Boyacá and Sardinata in Norte de Santander. The study contract was expected to be signed in mid-1979.

Salt.—Colombia was the third important producer of salt in Latin America after Mexico and Brazil. All salt mines, such as Zipaquirá and Nemocón, and marine salinas along the Caribbean coast of Guajira Peninsula are the property of the national Government. The Banco de la Republica, Concesion de Salinas, exploited the salt deposits under agreement with the Government. In 1978 Colombia produced 167,200 metric tons of soda ash (sodium carbonate) compared with 140,600 tons produced in 1977; 1979 output declined to 140,000 tons.

MINERAL FUELS

Colombia proceeded with its 10-year plan announced in 1976 to expand its energy resources, particularly coal, natural gas, and hydroelectric power. Self-sufficiency in petroleum output was planned to be attained in 1985.

A Colombian National Alcohol Committee, chaired by ECOPETROL, was established in 1979 to promote selective investment in depressed agricultural areas (including the Guajira) for growing yucca, potatoes, and sugar cane which could be converted into alcohol for a gasohol mixture. A national symposium in alcohol was planned for March 1980.

Coal.—The Congress of Colombia was studying a proposed bill to reform the code for coal mining. The bill would modify the basis for holding coal concessions in order to expedite exploitation of coal lands. A 5% production tax on coal was also proposed, to be used in part to set up a Fondo Nacional del Carbon charged with improving the transportation infrastructure in coal areas and to assist small and medium coal companies.

Production of coal in 1978 increased 17% to a historic high of almost 5 million tons compared with 2.5 million tons produced in 1970. But output was not sufficient to meet domestic demand and not indicative of Colombia's large potential. Output from the coal washing plant at the Paz del Rio steel complex increased 19% to a high of 612,000 tons. Although coal exports have increased greatly since 1954, the amounts have been modest. Exports of 85,800 tons in 1975 went mostly to Venezuela, Brazil, and Peru.

Planning was underway to increase coal output to serve a number of investment projects in order to reduce dependency on fuel oil. The reduction process at the Cerro Matoso nickel project was expected to use 40,000 tons of coal per year. Expansion of steel capacity at the Paz del Rio steel complex will require expansion of APR's own coal mines. There were also plans to expand coal use in electricity generating and cement plants projected in table 5. In

Table 5.— Colombia: Projections of coal demand and exports

(Million metric tons)

Year	Production		Domestic demand				Exports	
	High	Low	Total	Thermal power	Cement	For coke	High	Low
1980	7.1	6.9	6.1	1.2	0.89	0.65	1.0	0.75
1981	--	--	7.7	1.8	1.10	--	--	--
1982	--	--	8.0	1.8	1.27	--	--	--
1983	--	--	8.6	2.2	1.32	--	--	--
1984	--	--	8.8	2.2	1.37	--	--	--
1985	19.9	18.9	10.9	2.9	1.37	1.50	9.0	8.0
1990	41.1	28.1	13.1	4.1	NA	2.30	28.0	15.0
1995	60.7	34.7	15.7	NA	NA	2.90	45.0	19.0

NA Not available.

Source: Based in part on Urrutia, M., Bases para un Plan Energetico Nacional, Ministerio de Minas y Energia, Bogotá, 1977, Ch. 13.

1977, only 12% and 15% of total output of coal were used respectively in cement and electric power generation. Since Colombia has the largest known coal resources in Latin America, it was expected to become a significant coal exporter by 1985.

Carbones de Colombia S.A. (CARBOCOL), a state-controlled company set up for coal exploration and development, proceeded with its project to develop the open pit mining stage of Area A of the El Cerrejón coal deposit in the Guajira Peninsula. International Petroleum Colombia Ltd. (INTERCOL), an Exxon Corp subsidiary, was completing the second year of exploration in Area B of El Cerrejón in an association contract with CARBOCOL. Studies were underway on the infrastructure required, especially the railroad link to a Caribbean port site to be selected. INTERCOL was also investigating potential Latin American and European markets for Colombian coal.

The El Cerrejón deposit contains an estimated 3.5 billion tons of low-sulfur and low-ash coal. Colombia's total coal reserves of 40 billion tons includes 7 billion tons of measured reserves, 10 billion tons of inferred reserves, and 23 billion tons classified as potential reserves. This represents 59% of Latin America's total reserves estimated at 68 billion tons.[4]

Natural Gas.—Unlike the continuing decline in output of petroleum, production of natural gas continued its upward trend in 1978 and 1979. The increase was owing to the startup of gas production from the Guajira Peninsula in mid-1977. The Guajira gasfield was expected to reach its maximum yield of 450 million cubic feet per day in 1982 - equivalent to some 700,000 barrels per day of crude oil. During 1978 there were no significant gas discoveries to add to the major increases in gas reserves obtained in the 3 prior years, primarily offshore from Cartagena and the Guajira. However, in early 1978 a gas discovery offshore of Galerazamba near Cartagena was confirmed with indications of potential reserves two or three times the 3.5 billion cubic feet estimated for the Guajira fields. Onshore, INTERCOL was developing the Coral field in the Jobo block of the Lower Magdalena Valley.

In 1979, Texaco and ECOPETROL contracted El Paso Co. to study the feasibility of building a liquefied natural gas (LNG) plant in the Guajira east of Santa Marta to process gas from the Guajira onshore and offshore fields. The El Paso study concluded that the LNG plant would not be economically feasible. Nevertheless, Guajiran gas was being sold to industrial users in Barranquilla and Cartagena and to electric utilities along the Caribbean coast.

Promigas S.A. initiated studies on extending the gas pipeline from the Jobo Tablon gasfield south to Cartagena past the Cerro Matoso nickel deposit to Medellin and Cali with a branch to Bogotá - thus bringing gas service to the major industrial and residential centers of Colombia.

At yearend 1979 Colombia's reserves of natural gas were reported at 5.0 trillion cubic feet.

Petroleum.—Production of crude petroleum, which averaged 130,800 barrels per day in 1978 compared with 137,600 barrels per day in 1977, decreased 5% for the eighth consecutive year since 1970 when output peaked at 218,000 barrels per day. In 1979, estimated production was at 125,000 barrels per day. The downward trend was projected by the Ministry of Mines and Energy to continue until 1982 when output would average only 89,100 barrels per day. Production of refined petroleum products, especially motor gasoline, also declined overall by about 5% in 1978, while output of diesel oil

Table 6.—Colombia: Crude oil production, by company

(Thousand 42-gallon barrels)

Company	1976	1977	1978	Change (percent)
Texaco-Petrorio[1]	12,283	10,693	9,227	-13.7
ECOPETROL	9,680	9,095	8,980	-1.3
International Petroleum (INTERCOL)[2]	6,046	5,399	4,745	-12.1
Texaco (Texpet)	5,409	5,337	5,033	-5.7
Shell-Condor S.A	5,885	5,128	4,942	-3.6
Petroleos Colombo Brasileros	2,854	4,273	4,864	+13.8
Chevron Petroleum Co. of Colombia	4,222	3,701	2,984	-19.4
Colombian Petroleum Co.of South America Gulf	4,408	3,699	3,397	-8.2
Colombia-Cities Service Petroleum Corp. (COLCITCO)[3]	1,588	1,645	2,377	+44.5
ECOPETROL-Farmland	636	694	629	-9.4
Antex Oil and Gas Co.Inc	398	373	337	-9.6
Aquitaine Colombia S.A	--	184	--	--
Total	[r]53,376	50,221	47,743	-4.9

[r] Revised.

[1] Operated the Orito field - Putumayo, owned 50% by Texaco and 50% by Petrorio del Rio (Petrorio). Petrorio in turn is owned 50% by ECOPETROL and 50% by Cayman International Corp. Texaco sold its share in late 1979.

[2] Exxon Corp. affiliate.

[3] Cities Service, ECOPETROL, Amoco, and ARCO each own 25%.

and fuel oil increased slightly.

The major part of production continued to come from old oilfields covered by concession contracts. The companies involved have been attempting to get the Government to increase the prices for old oil. As a consequence of price control, marginal wells with production of 30 barrels per day or less have been shut in as production costs exceed revenues. To increase recovery ECOPETROL drilled water injection wells in the Casabe and La Cira fields.

Consumption of petroleum products increased only 2% in 1978, averaging 175,000 barrels per day. Colombia spent $121 million in 1978 on imports of 8.8 million barrels of crude oil from Venezuela and Ecuador, compared with 9.4 million barrels imported in 1977. Imports of crude oil have been trending upward since 1974, the last year Colombia exported crude oil. Imports of refined products from Brazil and the Netherlands were valued at $123 million. On the other hand Colombia continued to export fuel oil (to the United States mostly) which in 1978 was valued at $124 million for 11.1 million barrels. For the first 9 months of 1979, Colombia exported 6.7 million barrels of fuel oil valued at $99 million.

In March 1979, the Government announced a number of petroleum conservation measures, including increases in fuel prices. Regular gasoline increased in price 23% to $0.48 a gallon, and the price of natural gas increased 10%. In July 1979, the price of regular gasoline was again increased 29% to $0.61 per gallon. Despite these adjustments, ECOPETROL continued to subsidize the retail sale of gasoline and diesel oil, thus jeopardizing its financial condition.

During 1978 ECOPETROL entered into 11 new association contracts with foreign companies, bringing the total to 27 contracts. In late 1979, Texaco sold all of its interests in the Putumayo oil-producing region, including the 310-kilometer trans-Andean pipeline, to its partner, ECOPETROL. The Orito field in this region, one of Colombia's major producers, was discovered in 1963 by Texaco in a joint venture with Gulf. Startup of the pipeline to the coast was in March 1969.

There was an increase in exploratory drilling in 1978, but there were no major oil or gas discoveries. Up to 1982 Colombia expects to spend $750 million on increased drilling activity. In that year 58 exploratory wells are programmed compared with the average of 19 exploratory wells drilled over the period 1970-1978. According to ECOPETROL, in 60 years of exploration, only about one-fifth of Colombia's prospective sedimentary basins have been explored. Colombian geologists believe that areas such as the Mirador formation adjoining productive regions in Venezuela may also be productive in Colombia. In addition, the areas of Arauca, Casamare, Vichada, and possibly Meta may have up to 2 billion barrels of oil. This is thought to be the western limit of the Orinoco heavy oil belt.

The plains (Llanos) of eastern Colombia have long been considered to have oil potential. In 1978 Aquitaine Colombia S.A. and Chevron Petroleum Co. of Colombia tested 1,600 barrels per day at the Trinidad field discovery in the region's Meta basin.

In 1978 Colombia's proved oil reserves increased 9%, from 779 million barrels to 850 million barrels, of which ECOPETROL has 219 million barrels.

Uranium.—During 1978 the Empresa Colombiana de Uranio (COLURANIO) was conducting studies relating to the introduction of nuclear energy production in Colombia in the 1990's. Under contract with the Instituto de Asuntos Nucleares de Colombia (IAN), Minatome of France and the Empresa National del Uranio (ENUSA) of Spain were proceeding with their exploration activities. These association contracts with IAN will eventually be taken over by COLURANIO, established in 1977.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Colombian pesos (Col $) to U.S. dollars at the average exchange rate for 1978 of Col$39.32=US$1.00. In December 1978 the rate was Col$41.00=US$1.00.

[3] Siderurgia Latinoamerican-ILAFA. La Ferromineria Lationamerican '79. November 1979, pp. 50-64, No. 235.

[4] Instituto Latinamericano del Fierro y el Acero. Report on ILAFA Coal Congress, April 1979. Bogotá, p. XI.

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The Mineral Industry of Cyprus

By David E. Morse[1] and Candice Stevens[2]

Since 1974, the island of Cyprus has been divided into a northern sector controlled by the Federated Turkish Cypriots and a southern sector controlled by the Government of Cyprus. The information in this chapter concerns primarily the southern sector since no data were available on the northern sector.

The mineral industry contributed nearly 13% to the gross domestic product (GDP) of $1.3 billion[3] in 1978 and an estimated 12.5% to the 1979 GDP of $1.44 billion. The production of nonmetallic minerals has generally increased owing to higher demand in the local construction industry and export demand for asbestos. However, metal production has declined as a result of the closure of mines during the 1974 conflict and low world market prices. Mineral contribution to both GDP and export value has evidenced a steady decrease in real terms since 1974.

Cyprus' mineral industry was comprised of mostly private companies with the Government holding a small interest in petroleum refining. The Geological Survey Department was responsible for the investigation of groundwater and the conduct of mineral exploration. The Mines Department was responsible for the inspection of mines, issuance of prospecting permits, and mining safety and technical assistance.

PRODUCTION AND TRADE

There was very little overall change in the Cyprus mineral sector in 1978 and 1979. Asbestos, cement, and chromite output increased slightly. Output of copper concentrate, gypsum, pyrite, and lime was somewhat lower than the 1977 production levels. Mineral production statistics are given in Table 1.

Cyprus' balance-of-trade deficit continued to increase from $366 million in 1977 to $416 million in 1978 and $566 million in 1979. Major mineral export earners were cement, asbestos, copper concentrates, pyrite, chromite, and mineral pigments (umber and ochre). Minor mineral export earners were gypsum, salt, and clay minerals. The principal destinations were Western European countries with the United Kingdom as Cyprus' largest trading partner. The European Economic Community (EEC) was the country's largest supplier of imports. Petroleum imports were valued at $85.1 million in 1978 and $124.7 million in 1979 and represented 14% and 12.4% respectively of total material imports.

Table 1.—Cyprus: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Chromium ore and concentrate, marketable	9,156	14,281	15,359	18,000
Copper, mine output, metal content[2]	8,000	6,800	5,786	6,000
Zinc, mine output, metal content	867	179	--	--
NONMETALS				
Asbestos	34,518	36,684	34,342	36,000
Cement, hydraulic ______ thousand tons	1,026	1,071	1,107	[3]1,135
Clays, crude:				
Bentonite	5,080	13,200	13,651	14,000
Other:				
For brick and tile manufacture thousand tons	102	132	200	200
For cement manufacture ___do	171	444	272	300
Gypsum:				
Crude	54,379	73,312	50,700	[3]46,100
Calcined	10,241	10,544	18,100	[3]15,300
Lime, hydrated	31,902	28,262	15,000	18,000
Mineral pigments:				
Umber	20,300	27,400	29,695	30,000
Yellow ocher	[4]344	305	305	300
Salt, marine	3,318	--	--	--
Stone, sand and gravel:				
Dimension stone: Marble	28,450	34,500	38,400	40,000
Crushed and broken stone:				
Havara	792,500	812,800	1,000,000	1,000,000
Limestone:				
For cement production	712,166	865,458	976,443	1,000,000
Other	4,771	4,567	18,400	20,000
Marl, for cement production	651,587	685,901	646,111	650,000
Unspecified building stone	44,700	46,700	63,000	50,000
Sand and aggregate ___ thousand tons	2,184	3,353	3,972	4,000
Sulfur, S content of marketable pyrite	95,000	80,898	63,000	65,000
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery product:				
Gasoline __ thousand 42-gallon barrels	644	763	798	[3]850
Jet fuel and kerosine ___do	281	319	296	[3]298
Distillate fuel oil ___do	748	830	910	[3]986
Residual fuel oil ___do	790	829	861	[3]1,254
Other:				
Liquefied petroleum gas ___do	155	202	204	[3]256
Asphalt ___do	78	93	97	[3]110
Unspecified ___do	1	--	45	[3]32
Refinery fuel and losses ___do	179	196	130	[3]198
Total ___do	2,876	3,232	3,336	4,062

[e] Estimate. [p] Preliminary.

[1] In addition to the commodities listed, a variety of other crude construction materials is produced, but available information is inadequate to make reliable estimates of output levels.

[2] Includes the nonduplicative sum of Cu content of all exportable products, including copper concentrates, cuprous pyrites, cement copper, and copper precipitates.

[3] Reported figure.

[4] Exports.

Table 2.—Cyprus: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS			
Aluminum metal scrap	159	249	NA.
Chromium ore and concentrate	12,343	14,234	Austria 5,884; Poland 3,250; Italy 3,100.
Copper:			
Concentrate	[r]40,386	31,215	U.S.S.R. 15,212; Spain 14,318.
Metal scrap	[r]116	139	Spain 68; United Kingdom 43; Greece 28.
Gold ... value	$15,841	$96,011	NA.
Iron and steel metal:			
Scrap	5,068	1,558	NA.
Semimanufactures:			
Bars, rods, angles, shapes, sections	125	161	NA.
Universals, plates, sheets	133	120	NA.
Hoop and strip	2	NA.	
Tubes, pipes, fittings	231	346	NA.
Tin metal scrap	660	--	
Zinc metal scrap	29	39	NA.
NONMETALS			
Asbestos, crude	33,552	35,341	United Kingdom 7,720; Ireland 5,469; Denmark 5,172.
Cement	[r]732,966	757,079	Saudi Arabia 253,002; Syria 213,550; Egypt 153,198.
Clays and other refractory minerals	6,720	8,761	Israel 6,060; Egypt 1,524; Dubai 762.
Gypsum and anhydrite	11,208	39,108	Kenya 33,002; Malawi 2,500; Saudi Arabia 1,201.
Lime, hydraulic	98	697	NA.
Pigments, mineral, natural, crude	10,581	11,070	United States 6,745; United Kingdom 2,809.
Pyrites, unroasted	146,853	174,361	Greece 106,942; Egypt 49,419; Italy 18,000.
Stone, sand and gravel:			
Dimension stone, crude and partly worked, calcareous	123	468	NA.
Gravel and crushed rock	76	21	NA.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline, motor ... thousand 42-gallon barrels	[r]299	39	All to Lebanon.
Liquefied petroleum gas ... do	(1)	--	
Lubricating oil ... do	5	5	Mainly to Lebanon.

[r] Revised. NA Not available.

[1] Less than 1/2 unit.

Table 3.—Cyprus: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum metal including alloys, all forms	[r]1,296	2,804
Copper:		
Copper sulfate	70	--
Metal including alloys, all forms	208	370
Gold metal, including platinum-plated, unwrought and semimanufactures ... troy ounces	17,135	19,958
Iron and steel metal:		
Pig iron, ferroalloys, similar materials	573	2,014
Steel, primary forms	3	14
Semimanufactures:		
Bars, rods, angles, shapes, sections	[r]39,600	67,567
Universals, plates, sheets	[r]10,595	16,405
Hoop and strip	87	783
Rails and accessories	(1)	--
Wire	2,117	2,835
Tubes, pipes, fittings	[r]13,251	16,806
Castings and forgings, rough	20	15
Lead:		
Oxides	344	601
Metal including alloys, all forms	114	800
Manganese oxide	14	27
Nickel metal including alloys, all forms	9	7
Platinum-group metals, unwrought and partly worked, but not rolled ... troy ounces	4	19
Silver metal, unwrought or partly worked ... do	298,218	322,082
Tin metal including alloys, all forms	379	614

See footnotes at end of table.

Table 3.—Cyprus: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS —Continued		
Titanium oxides	219	284
Zinc:		
Oxide and peroxide	4	3
Metal including alloys, all forms	13	52
Other:		
Oxides of metals	(1)	--
Base metals including alloys, all forms ……value	$2,949	$2,422
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	22	746
Grinding and polishing wheels and stones ……value	$80,970	$111,280
Cement	r4,488	6,445
Chalk	763	1,504
Clays and clay products (including all refractory brick):		
Crude	191	185
Products:		
Refractory (including nonclay brick) ……value	$511,248	$455,472
Nonrefractory ……do	$691,123	$1,797,698
Diamond, gem, not set or strung ……do	$42,968	$63,228
Diatomite and other infusorial earth	83	47
Fertilizer materials:		
Manufactured:		
Nitrogenous	r17,092	19,594
Phosphatic	2,401	3,172
Potassic	270	708
Other, including mixed	r28,959	32,474
Ammonia	20	31
Gypsum and plasters	61	38
Pigments, mineral:		
Natural, crude	61	47
Iron oxides, processed	16	27
Precious and semiprecious stones, except diamond:		
Natural ……value	$12,220	$56,258
Manufactured ……do	$15,061	$23,414
Salt and brines	504	2,069
Sodium and potassium compounds, n.e.s.:		
Caustic soda	371	408
Caustic potash and sodic and potassic peroxides	3	1
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	459	1,099
Worked ……value	r$18,963	$93,356
Gravel and crushed rock	203	514
Sand, excluding metal bearing	199	131
Sulfur:		
Elemental, other than colloidal	2,518	2,420
Sulfur dioxide	86	134
Sulfuric acid, including oleum	320	298
Talc, steatite, soapstone, pyrophyllite	297	607
Other, crude ……value	r$22,887	$24,375
MINERAL FUELS AND RELATED MATERIALS		
Coal, anthracite and bituminous	79	35
Coke and semicoke	40	380
Peat, including peat briquets and litter	343	700
Petroleum:		
Crude and partly refined ……thousand 42-gallon barrels	2,940	3,084
Refinery products:		
Gasoline, including natural ……do	375	67
Kerosine and jet fuel ……do	r59	17
Distillate fuel oil ……do	261	235
Residual fuel oil ……do	1,164	2,456
Lubricants ……do	r39	52
Other:		
Liquefied petroleum gas ……do	168	80
Mineral jelly and wax ……do	2	3
Bitumen and other residues and bituminous mixtures, n.e.s ……do	4	7
Unspecified ……do	(1)	--
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ……value	r$3,219	$14,150

rRevised.

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Chromite.—Hellenic Mining Co., Ltd's (HMC) two major chromite mines were located in the Troodos Mountains and had a combined production capacity of 40,000 tons per year of ore. The bulk of production came from the Kokkinorotsos mine and the remainder from the Kannoures mine. Ore was beneficiated at the treatment plant located at Aylos Nikolaos. Chromite exports totaled 10,972 tons in 1978 and 10,530 tons in 1979.

Copper.—Copper production has evidenced a slow decline from the levels of previous years as mines have closed owing to civil conflict and low metal prices. Cyprus Island Division, a subsidiary of Cyprus Mines Corp. (CMC), ceased producing copper concentrate, cement copper, and precipitated copper in 1974. Its mines at Mavrovouni, Skouriotissa, and Aplika were previously the largest copper producers in the country. In 1977, Kampia Mines Ltd. ceased mining operations at its open pit mines at Peristerka and Pitharochoma. It previously mined 15,000 tons per year of ore and produced copper and zinc concentrates.

HMC accounted for about 60% of production in 1978 and 1979. It operated a number of small mines in the Troodos Mountains with the major part of production coming from the Kalavasos, Nitsero, and Parekklishia leases. Total production capacity was estimated at 30,000 tons per year of copper concentrate.

Cyprus Sulphur and Copper Co. Ltd. accounted for the remainder of production. Reserves at the Limni mine, located in the west near Polis, were estimated at 2 million tons grading 1.1% copper.

Exploration for copper mineralization continued by Noranda Exploration (Cyprus) Ltd., a subsidiary of Noranda Ltd. (Canada). It was reported in 1978 that the economic potential of substantial reserves of copper sulfide ore was under investigation. The Geological Survey Department was to undertake mineral surveys in conjunction with the United Nations Revolving Fund beginning in 1978. The focus was to be on chalcopyrite ore in a 1,4000-square-kilometer area.

NONMETALS

Asbestos.—Cyprus Asbestos Mines Ltd. mined approximately 5 million tons of rock and produced nearly 35,000 tons of long-fiber and short-fiber chrysotile asbestos in both 1978 and 1979. Approximately 95% of production was exported to Western European countries. All asbestos production came from the Amiamlos mine in the Troodos Mountain region. Cyprus Asbestos Mines Ltd. was planning the construction of a plant for the production of asbestos cement products at Limassol. Asbestos exports of 28,875 tons in 1978 and 38,489 tons in 1977 were valued at $10.6 million and $15 million, respectively.

Cement.—Cyprus produced over 1.1 million tons of cement in 1978 and 1979. Exports of over 600,000 tons, went primarily to Syria and other Arab countries. Cement production capacity of the country's two plants was 1.2 million tons per year. The Cyprus Cement Co. Ltd. plant, owned by this Galatariotas Group, began production in the late 1950's and has attained a capacity of 450,000 tons per year. The plant operated by the Vassiliko Cement Works Ltd., a subsidiary of HMC, began operating in 1967 at an initial capacity of 180,000 tons per year and has attained a capacity of 750,000 tons per year. Extensions to the facility were to increase its capacity to 1.2 million tons per year by 1981.

Fertilizer Materials.—Hellenic Chemical Industries Ltd., a subsidiary of HMC, planned to establish a domestic fertilizer complex at Vassiliko. Annual production capacity of the facility was to be 180,000 tons of sulfuric acid, 150,000 tons of complex fertilizer materials, and 40,000 tons of phosphoric acid. The sulfuric acid unit, which was to use locally produced iron pyrites as feedstock, was to be constructed by the Soviet firm Techmashimport. The phosphoric acid unit, which was to use imported Syrian phosphate rock, was contracted to the West German firm Lurgi. Cyprus imported a variety of manufactured fertilizers valued at $5.2 million in 1978 and $10.4 million in 1979.

Gypsum.—Total production capacity of the private firms that operated gypsum quarries in the area north of Vasilikos and Larnaca was about 100,000 tons per year. The largest producer was United Gypsum Ltd., a subsidiary of HMC. Production capacity of its quarry in the Psematismenos area was 70,000 tons per year. The Peletico Ltd. quarry near Larnaca had an annual production capacity of 10,000 tons per year. The foremost among several smaller producers was Limassol Chemical Products

Ltd., which produced about 1,000 tons per year of gypsum for use in local plaster production.

Mineral Pigments.—Cyprus exported nearly 10,500 tons of iron oxide pigments in 1978 and 10,219 tons in 1979. Production consisted primarily of umber and yellow ocher, but Cyprus also possessed reserves of terra verte and sienna. Most of the umber and ocher pigment deposits of Cyprus occur in the Cretaceous sediment of the Perapedhi Formation at localities scattered around the Troodso Massif and the Troulli Inlier. The principal producers of mineral pigments were A.L. Matovani & Sons Ltd., Messrs. Zenon Peirides & Sons Ltd., and Cyprus Umber Industrial Co. Ltd., all headquartered in Larnaca.

MINERAL FUELS

Petroleum.—The Cyprus Petroleum Refinery Ltd. facility at Larnaca on the island's southern coast continued to operate at less than capacity of 16,000 barrels per day in both 1978 and 1979. The oil refinery was owned by Shell Oil Co. (25.5%), British Petroleum Co. Ltd. (25.5%), Mobil Oil Co. (34%), and the Cyprus Government (15%). Most of the imported crude oil treated by the refinery came from Iraq in both 1978 and 1979 with lesser amounts supplied from Algeria, Libya and Saudi Arabia.

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[1] Physical scientist, Branch of Foreign Data.

[2] Economist, Branch of Foreign Data.

[3] Where necessary values have been converted from Cyprus pounds (LC) to U.S. dollars at a rate of LC1 = US$2.847 for 1978 and LC1 = US$2.8985 for 1979.

The Mineral Industry of Czechoslovakia

By Tatiana Karpinsky[1]

Czechoslovakia has large reserves of coal, lignite, antimony, magnesite, mercury, uranium, graphite, kaolin, and other clays, glass sand, limestone, and building materials, but the country remains deficient in oil, natural gas, iron ore, and nonferrous metal ores.

The coordination of national economic plans with the U.S.S.R. and other CMEA[2] countries, and long-term agreements, assure the greater part of the country's raw material and energy needs.

In the present 5-year plan (1976-80), the Soviet Union is to supply Czechoslovakia with about 36 million tons of iron ore (metal content), 5 million tons of pig iron, manganese ore, and ferroalloys, more than 200,000 tons of nonferrous metals,[3] and 88.1 million tons of crude oil.[4] Development of Czechoslovakia's economy continued in 1978 and 1979. In 1978 the national income increased 4% over that of 1977 and reached approximately 430 billion korunas (Kcs).[5] In 1979 the national income was 2.6% to 2.8% greater than in 1978. The total industrial output was Kcs583.0 billion in 1978,[6] about Kcs27 billion more than in 1977, 85% of the increase reportedly was achieved through higher productivity. In 1979 industrial production increased 3.7% over that of 1978; however, the growth of industrial production was lower than planned.

More than 20% of the country's industrial enterprises failed to fulfill the plan. Insufficient improvement of efficiency was a basic weakness of the country's development in 1979.[7] The enterprise production plans in nonferrous industry were generally fulfilled.[8]

In 1978 mining and quarrying contributed 4.5% to the total industrial production, of which the share of coal was 3.4%, crude oil 0.1%, metallic ore 0.5%, and other mining 0.5%.[9]

Production of the mineral processing industry contributed 4% to the total industrial production in 1978; production of the iron and steel industry, 9.6%; production of the nonferrous industry, 2.6%; and other nonmetallic mineral products, 2.8%. Contributions of mining and quarrying to the total industrial production in 1979 were estimated as approximately the same level as in 1978.

Investments into the national economy in 1978 totaled Kcs135 billion, of which about Kcs60 billion went into new machines and equipment. The share of machines and equipment continued to increase in capital construction, which was directed to fuel and energy projects and to the development of production lines and specially to those using domestic raw materials.[10] In comparison with 1978, 1.6% more funds were invested in the national economy.[11]

Capital construction in 1979 was directed to the development of the fuel-power base, with emphasis on the role of engineering, the chemical industry, and production based on domestic raw materials. In 1979, the following facilities among others were put into operation: the Jiri II coal mine (first stage); the first 440 megawatts block of nuclear powerplant V-I at Jaslovske Bohunice; two aggregates (30 megawatts each) in the Detmorovice thermal powerplant; and the central oxygen plant at Klement Gottwald New Metallurgical Plant in Kunice.

The number of industrial workers employed in state enterprises in Czechoslovakia totaled 2,874,000 in 1978, and the number of employees totaled 1,998,000. The number of workers and employees in state mineral and enery enterprises by branch (in thousands) follows:

Branch	Workers	Employees	Number of enterprises
Fuel extraction and processing industry	172	134	59
Power and heat generation	54	36	27
Ferrous metallurgy (including ore mining)	167	123	14
Nonferrous metallurgy (including ore mining)	42	30	20

In 1978-79, Czechoslovakia continued to participate in multilateral projects of the CMEA countries including construction of the Soyuz long-distance pipeline, construction of facilities for production of iron ore and production of ferroalloys on the territory of the Soviet Union, construction of an oil pipeline from an Adriatic seaport in Yugoslavia to Czechoslovakia, and many others.

The Soyuz gas pipeline was placed in service in January 1979, and Czechoslovakia is to receive an additional 2.8 billion cubic meters of gas annually beginning in 1980.[12]

The Soviet Union received almost all Czechoslovak equipment for the building of Soviet plants to produce ferroalloys in 1978, and deliveries of Czechoslovak equipment for the construction of iron ore dressing plants were also nearing completion in the year.[13]

In return Czechoslovakia is to receive iron ore and concentrates and other raw materials from the U.S.S.R. Czechoslovakia joined other countries in construction of facilities for the production of nickel in Cuba.

Exploration for raw materials in Czechoslovakia showed that Slovakia can contribute to the country's self-sufficiency in antimony and mercury; reportedly, copper production can be increased fivefold and lead and zinc production doubled. It is believed that Slovakia will be able to provide 5% of the country's needs of iron, 16% of copper, 11% of lead, 25% of zinc, and 20% of tungsten in the future. The further prospecting for lead, zinc, and copper is to be concentrated at the Banska Stiavnica deposits in the vicinity of the old mines and in the Slanske Hills near Zlata Bana. The results of geological prospecting have ensured a further expansion of output of ceramic raw materials, especially kaolin. In 1978, priority was assigned fo the development of tin ore mining and construction of new plants for processing the tin ore.[14]

Government Policies and Programs.—The 1980 plan for the development of the national economy is based on the policy set by the 15th Congress of the Communist party of Czechoslovakia. According to the plan, national income in 1980 is to increase 3.7%. Industrial production is to increase 4%. About 91% to 92% of the growth in national income is to be achieved by increased labor productivity. The 1980 plan calls for a 6.7% increase in pig iron production, and in increases of 5.5% in steel, 5.3% in rolled steel, and about 1.2% in coal and lignite production. In 1980, 1,272 megawatts of new power generating capacity are expected to come onstream. Special attention is to be paid to ensuring the development of the country's fuel and energy base, with particular emphasis on the production and deliveries of machinery for strip and deep mining and of equipment for the nuclear power engineering sector.[15]

PRODUCTION

In comparison with 1978 year, production output in 1979 went up slightly in all industries except steel and heat and power generation. Steel production was lower than in 1978. Electric energy production in 1979 was 1.5% less than in 1978. The nuclear plant V-1 Jaslovice Bohunice produced about 1.5 billion kilowatt-hours of electric energy.[16] The state plan for total coal and lignite production was fulfilled 99.7% in 1978 and 100% in 1979. The Ostrava-Karvina coal basin supplied more than 85% of all bituminous coal mined. Production of bituminous coal was under increasingly greater depth and under more difficult geological and mining conditions. The North Bohemian basin supplied about 73% of the brown coal output. This field experienced considerable difficulty in meeting the planned output for 1978 and 1979 because of severe winter conditions and delays in deliveries of coal mining machinery. Reportedly in 1979 the production of equipment for nuclear powerplants increased 95.9% over that of 1978, and production of machinery for surface mining of brown coal increased

47.8%.

The total output of ore in 1979 increased 2% over that of 1978; production of the nonferrous metals industry increased 2.8% and ferrous industry 1.9%.

In 1977, the Czechoslovakian Government reported that metallic ore reserves in the country are much larger than had been estimated. Output of nonferrous metals is expected to be increased after 1985.

Domestic uranium ore deposits were mined under U.S.S.R. control. All production was exported to the U.S.S.R. Considerable increase in uranium production is planned at Pribram and in North Bohemian regions in the near future.

The nonmetallic minerals industry in Czechoslovakia was producing magnesite from the Slovak deposits and kaolin and refractory clays from newly developed deposits. Development of the 150 million tons of feldspar reserves in the Jindrichuv area was expected to make Czechoslovakia self-sufficient in the near future.

In 1978-79 output of natural gas was insignificant; however, there is a possibility of some production increases in the future. About 18.4 million tons of petroleum were processed in both 1978 and 1979. Some 94% of Czechoslovakia's supplies of crude oil came from the U.S.S.R. The Druzba pipeline constituted the main source of crude oil. Domestic crude oil production continued to be insignificant.

Table 1.—Czechoslovakia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Alumina[e]	90,000	95,000	100,000	100,000
Aluminum ingot, primary only	36,019	36,544	36,823	37,000
Antimony:[e]				
Mine output, metal content	[r]285	[r]300	300	300
Metal	[r]700	[r]700	700	700
Copper:				
Mine output, metal content	5,000	5,230	5,460	5,600
Metal:				
Smelter	7,100	7,000	7,000	10,000
Refined, including secondary	22,052	23,067	23,810	24,500
Iron and steel:				
Iron ore:				
Gross weight thousand tons	1,904	1,994	2,023	2,028
Metal content do	573	598	607	615
Metal:				
Pig iron do	9,473	9,715	9,944	9,640
Ferroalloys:				
Blast-furnace do	2	--	--	--
Electric-furnace do	[r]140	180	182	175
Crude steel do	14,693	15,064	15,294	[3]14,800
Semimanufactures:				
Rolled steel do	10,392	10,588	10,787	[3]10,781
Pipes and tubes	1,461	1,483	1,510	[3]1,536
Lead:				
Mine output, metal content	4,183	4,300	3,981	4,000
Metal, including secondary	19,116	19,015	19,042	19,130
Manganese ore, gross weight[3]	1,099	910	900	900
Mercury 76-pound flasks	6,200	5,950	6,370	6,300
Nickel metal, primary[e]	[r]3,500	[r]4,000	4,000	4,000
Silver thousand troy ounces	1,190	1,192	1,300	1,300
Tin:				
Mine output, metal content	180	180	180	180
Metal, including secondary	120	120	120	120
Zinc, mine output, metal content	9,260	9,400	8,772	9,070
NONMETALS				
Barite[e]	7,500	7,500	7,500	7,500
Cement, hydraulic thousand tons	9,552	9,749	10,200	[3]10,206
Clays: Kaolin do	545	580	592	600
Fluorspar[e]	93,000	96,000	96,000	98,000
Gypsum and anhydrite, crude thousand tons	660	682	700	700
Lime (hydrated, and quicklime) do	2,966	3,021	3,078	3,000
Magnesite, crude do	654	661	657	660
Nitrogen, N content of ammonia do	[r]725	791	817	816
Perlite[e]	10,000	10,000	10,000	10,000
Pyrite, gross weight thousand tons	111	122	134	140
Salt do	244	254	258	260
Sodium and potassium compounds:				
Caustic soda do	293	312	311	312
Sodium carbonate, manufactured do	119	118	121	121

See footnotes at end of table.

Table 1.—Czechoslovakia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Stone: Limestone and other calcareous stone do	22,312	22,761	23,174	23,500
Sulfur:				
Native do	12	5	5	5
From pyrite do	50	55	60	60
Byproduct, all sources do	10	9	10	10
Total do	72	69	75	75
Sulfuric acid do	1,240	1,276	1,200	1,100
MINERAL FUELS AND RELATED MATERIALS				
Carbon black[e]	30,000	30,000	30,000	30,000
Coal:				
Bituminous thousand tons	27,737	27,450	27,799	[2]28,463
Brown do	86,838	90,696	92,450	[2]93,731
Lignite do	3,488	3,354	3,269	2,506
Total do	118,063	121,500	123,518	124,700
Coke:				
Metallurgical do	9,007	8,816	8,809	8,500
Unspecified do	1,886	2,045	1,976	1,958
Total do	10,893	10,861	10,785	[2]10,458
Fuel briquets from brown coal do	1,311	1,255	1,130	1,200
Gas:				
Manufactured, all types million cubic feet	281,571	279,094	282,136	282,000
Natural, marketed[4] do	33,641	35,355	26,129	26,000
Petroleum:				
Crude:				
As reported thousand tons	131	123	117	115
Converted thousand 42-gallon barrels	888	834	793	780
Refinery products:[5]				
Gasoline do	13,472	13,940	13,917	14,157
Kerosine do	2,310	2,612	3,658	3,751
Distillate fuel oil do	29,556	31,034	31,670	32,066
Residual fuel oil do	56,404	57,289	58,484	59,250
Lubricants do	1,792	1,960	[e]1,925	1,936
Liquefied petroleum gas do	1,659	1,693	[e]1,720	1,694
Asphalt and bitumen do	7,932	7,836	[e]7,880	7,986
Paraffin wax do	110	[e]120	[e]120	121
Total do	113,235	116,484	119,374	121,000

[e] Estimate. [p] Preliminary. [r] Revised.

[1] In addition to the commodities listed, arsenic, gold, uranium, feldspar, graphite, and a variety of other petroleum products are produced, but information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

[3] This material, although reported as manganese ore, is believed to be manganiferous iron ore with an Mn content of about 17% and as such is not equivalent to material ordinarily reported as manganese ore, which generally contains 25% or more Mn.

[4] Includes gas produced from coal mines. Gross output of natural gas is not reported, but it is believed to exceed reported marketed output by a relatively inconsequential amount.

[5] Data presented are for those products reported in official Czechoslovak sources and in United Nations publications; no estimates have been included for other products or for refinery fuel and losses.

TRADE

In 1978-79, about two-thirds of Czechoslovakia's total foreign trade was with centrally planned economy countries. Half of this was with the Soviet Union, which supplied the main part of all Czechoslovakia's raw materials, including almost all of is oil, gas, and iron ore. In return Czechoslovakia supplied machines and other industrial products to the U.S.S.R.[17]

In 1978, exports of machinery and equipment contributed 53% of the total export value; fuels, mineral raw materials, and metals 15%. The value of machinery and equipment amounted to 40% of the total import; fuel, mineral raw materials, and metals 30%.[18] Czechoslovak imports of selected commodities in 1978 follows:[19]

Commodities	Total value (million korunas)	Centrally planned economy countries (million korunas)	Percent	Market economy countries (million korunas)	Percent
Ferrous ores	1,818	1,522	84	296	16
Ferrous metals	1,671	1,851	70	820	30
Nonferrous metals	2,482	2,052	83	429	17

Czechoslovakia's total trade turnover with various country groups for 1978 is shown in the following tabulation:

	Trade turnover (million korunas)	Percentage share
CMEA and other centrally planned economy countries	95,852	72.7
Developed market economy countries	27,283	20.7
Developing countries	8,651	6.6
Total	131,786	100.0

The trade balance showed that the total deficit in 1978 was Kcs4.4 billion. Czechoslovakia's trade balance for 1978 was as follows:[20]

	Million korunas
CMEA countries	-2,423
Other centrally planned economy countries	377
Western developed countries	-4,351
Developing countries	2,035
Total balance	-4,362

In 1979 total turnover had been 14% greater than in 1978: 12.4% greater in trade with centrally planned economy countries and 16.8% greater in the trade with market economy countries; exports increased 16% and imports 12.1%. Trade with the developing countries also increased considerably.

A trade protocol for 1980 between the U.S.S.R and Czechoslovakia was signed on December 14, 1979. According to the protocol, trade turnover between the two countries will reach some 7.0 billion rubles, an increase of about 6% over that of 1979. As before, machinery and equipment will account for the largest share in Czechoslovak exports to the U.S.S.R. Primary products and raw materials including crude oil, gas, bituminous coal, iron ore, metals, and electric power will remain the leading commodity group in Czechoslovak imports. They will amount to almost two-thirds[21] of the total imports from the U.S.S.R. A trade and payment agreement for 1980 between Albania and Czechoslovakia was signed on October 22, 1979. Czechoslovakia will export machinery and equipment and import iron-nickel ore, chromium ore, and asphalt.

A protocol on commodity exchanges and payments for 1980 between Vietnam and Czechoslovakia was signed on October 24, 1979. Czechoslovakia will supply mainly rolled stock and machinery and import zinc, lead, tin, anthracite, and other commodities from Vietnam. A protocol on the exchange of goods between Czechoslovakia and Hungary for 1980 is to be worth 1,420 million rubles. It was signed on December 6, 1979. Hungary will export to Czechoslovakia bauxite, aluminum products, and other goods and will import from Czechoslovakia coke, rolled stock, and other commodities.

The signing of a contract for over Kcs200 million, between STROJEXPORT Foreign Trade Corporation on the one hand and the Weserhutte consortium from the Federal Republic of Germany and Precismeca from France on the other, completed the fourth stage of supplies for a long-distance belt-conveyer system for Czechoslovakia. The equipment, earmarked for the Maxim Gorki Mine in the North Bohemian coal district, will be put into service in the first half of 1981.[22]

In October 1979, Czechoslovakia and Yugoslavia signed a protocol on the Exchanges of Goods and Services for 1980. The turnover of the mutual exchange of goods and services will amount to about $1.2 billion, 15% over that of 1979. Imports from Yugoslavia will include nonferrous metals and bauxite.[23] Reportedly, an agreement is to be signed shortly providing for a Czechoslovakia credit of 115 million dinars for the Yugoslavia aluminum industry; 32,000 tons of aluminum products is to be exported to Czechoslovakia in return.

Czechoslovakia is Mongolia's second largest partner, after the Soviet Union. Exports and imports are balanced. In 1979, the mutual turnover of goods amounted to more than R20 million. Raw materials and livestock products accounted for more than

60% of Mongolia's exports.[34]

Under agreements on nuclear power industry development signed with the U.S.S.R., Czechoslovakia is to make by 1985 (for its own needs and for export) 23 sets of equipment for 440 megawatt units, and expects to start making equipment for 1,000 megawatt units after 1985.

Table 2.—Czechoslovakia: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite	--	215	All to Austria.
Oxide and hydroxide	41	61	Switzerland 60.
Metal including alloys:			
Scrap	1,930	4,996	Austria 2,817; West Germany 1,954.
Unwrought	14,704	18,815	Japan 18,173.
Semimanufactures	3,130	5,692	Poland 4,212; Hungary 1,422.
Antimony metal including alloys, all forms	16	90	All to Spain.
Chromium oxides and hydroxides	--	15	All to Netherlands.
Copper:			
Ore and concentrate	1,003	495	All to United Kingdom.
Copper sulfate	1,855	2,070	West Germany 826; Italy 460; Spain 300.
Metal including alloys:			
Scrap	692	662	West Germany 660.
Unwrought	8,597	10,285	West Germany 10,260.
Semimanufactures	1,847	3,174	Poland 3,104.
Iron and steel:			
Ore and concentrate thousand tons	48	7	All to Austria.
Metal:			
Scrap do.	81	114	Italy 86; Austria 20.
Pig iron do.	[3]28	[3]23	Sweden 2; West Germany 1.
Ferroalloys do.	36	35	West Germany 18; United Kingdom 6.
Steel, primary forms[4] do.	420	521	Yugoslavia 292; Italy 62; Bulgaria 28.
Semimanufactures:			
Bars, rods, angles, shapes, sections do.	[3]1,139	[3]1,138	West Germany 121; East Germany 80; Poland 73.
Plates and sheets[4] do.	1,000	906	France 109; Yugoslavia 95; West Germany 88.
Hoop and strip do.	[3]235	[3]225	West Germany 17; Yugoslavia 12; France 11.
Rails and accessories do.	[3]39	[3]18	NA.
Wire do.	[3]100	[3]119	West Germany 17; Hungary 17.
Tubes, pipes, fittings[4] do.	412	549	U.S.S.R. 378; West Germany 21.
Castings and forgings do.	[3]39	[3]42	Poland 5.
Unspecified[4] do.	1,282	1,519	NA.
Lead:			
Ore and concentrate	7,587	7,088	West Germany 5,345.
Metal including alloys:			
Scrap	282	176	All to West Germany.
Unwrought	--	9	Do.
Semimanufactures	--	11	Egypt 10.
Magnesium metal including alloys, scrap	30	24	All to West Germany.
Manganese metal including alloys, all forms	--	65	Do.
Mercury 76-pound flasks	--	([5])	All to Yugoslavia.
Molybdenum metal including alloys, all forms	--	4	All to West Germany.
Nickel metal including alloys:			
Scrap	64	302	All to West Germany.
Semimanufactures	--	44	All to United Kingdom.
Platinum-group metals and silver:			
Waste and sweepings value, thousands	$748	$683	United Kingdom $583.
Metals, unworked or partly worked:			
Platinum group do.	--	$74	West Germany $62.
Silver do.	$841	$63	All to United Kingdom.
Tin ore and concentrate	184	111	All to West Germany.
Titanium oxides	3,118	2,833	Italy 820; United Kingdom 698.
Tungsten:			
Ore and concentrate	129	67	West Germany 60.
Metal including alloys, all forms kilograms	--	10	All to Yugoslavia.
Zinc:			
Ore and concentrate	19,233	11,518	West Germany 5,898; Belgium-Luxembourg 5,579.
Oxide and peroxide	195	256	West Germany 182.
Metal including alloys:			
Scrap	125	165	All to West Germany.
Unwrought	25	--	
Other:			
Ash and residue containing nonferrous metals	379	7,174	West Germany 4,848; Austria 1,865.
Base metals including alloys, all forms	49	12	West Germany 11.

See footnotes at end of table.

Table 2.—Czechoslovakia: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc	101	87	Hungary 66.
Grinding and polishing wheels and stones	172	718	Egypt 212; West Germany 135; Thailand 111.
Barite and witherite	1,162	8,541	West Germany 7,234.
Cement[4] thousand tons	321	286	Yugoslavia 90; West Germany 89; Poland 77.
Clays and clay products:			
Crude:			
Fire clay do	--	33	All to Yugoslavia.
Fuller's earth and chamotte do	136	134	Hungary 81; West Germany 58.
Kaolin[4] do	412	382	West Germany 111; Poland 71; Austria 55.
Other do	97	196	West Germany 98; Hungary 48; Austria 38.
Products:			
Refractory do	45	60	West Germany 28; Poland 13; Sweden 10.
Nonrefractory do	21	18	Yugoslavia 8; Austria 5; Denmark 2.
Diamond:			
Gem, not set or strung value, thousands	--	$685	All to Belgium-Luxembourg.
Industrial do	$60	$125	Do.
Diatomite and other infusorial earth	533	706	Austria 580.
Fertilizer materials:			
Crude, nitrogenous	--	28	All to France.
Manfactured:			
Nitrogenous, N_2 content	[3]23,600	[3]21,600	West Germany 7,735; Yugoslavia 6,335.
Potassic	--	351	All to Yugoslavia.
Other, including mixed	2,685	578	All to West Germany.
Ammonia	--	6,837	Poland 6,280.
Graphite, natural	288	509	Yugoslavia 418.
Lime	16,850	24,997	Hungary 24,989.
Magnesite[4] thousand tons	367	382	West Germany 111; Romania 89; Poland 71.
Mica, worked	76	94	Yugoslavia 35; United Kingdom 24.
Pigments, mineral:			
Natural, crude	2,934	2,210	All to Hungary.
Iron oxides, processed	1,509	1,941	NA.
Precious and semiprecious stones value, thousands	$38	$112	West Germany $36; Hong Kong $32.
Salt	8,369	8,692	All to Hungary.
Sodium and potassium compounds, n.e.s.:			
Caustic soda[4]	42,971	47,020	West Germany 19,232; Hungary 17,517.
Caustic potash	276	445	West Germany 89; Italy 61; Brazil 55.
Soda ash	[3]13,300	[3]16,800	Mainly to the West Germany.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	29,879	1,668	West Germany 1,530.
Worked	1,894	5,534	West Germany 4,450; Egypt 958.
Dolomite	--	11	All to Greece.
Gravel and crushed rock	33,413	72,204	Hungary 60,245.
Limestone	24,046	22,754	All to West Germany.
Quartz and quartzite	--	63	Netherlands 26; West Germany 24.
Sand, excluding metal bearing	241,486	314,160	Austria 222,805; Hungary 91,304.
Sulfur, elemental, other than colloidal	--	32	All to West Germany.
Talc	4,580	6,655	Poland 6,615.
Other:			
Crude	22,444	29,869	Hungary 11,853; West Germany 9,690.
Slag, dross, similar waste	20,558	21,006	All to West Germany.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	--	8	Egypt 6.
Coal and briquets:			
Anthracite and bituminous coal[4] thousand tons	3,308	3,745	Romania 861; Austria 639; Yugoslavia 694.
Briquets of anthracite and bituminous coal do	--	284	Yugoslavia 283.
Lignite and lignite briquets do	2,031	1,991	East Germany 798; Austria 412; Romania 348.
Coke and semicoke[4] do	1,654	1,515	East Germany 1,471.
Gas, natural million cubic feet	[3]2,016	[3]2,022	Hungary 398.
Peat and peat briquets	--	169	Netherlands 109; West Germany 33.

See footnotes at end of table.

Table 2.—Czechoslovakia: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum:			
Crude thousand 42-gallon barrels	[3]5,520	[3]2,308	NA.
Refinery products:			
Gasoline do	[3]1,080	[3]901	West Germany 782.
Kerosine do	75	150	Hungary 88; Yugoslavia 62.
Distillate fuel oil do	[3]1,074	[3]1,112	Mainly to West Germany.
Residual fuel oil do	58	75	All to Austria.
Lubricants do	[3]154	53	Austria 41.
Other:			
Liquefied petroleum gas do	804	659	West Germany 387; Italy 218.
Mineral jelly and wax do	6	3	Mainly to Finland.
Nonlubricating oil do	708	--	
Bitumen and other residues do	8	10	All to Austria.
Mineral tar and other coal-, petroleum- or gas-derived crude chemicals	27,106	35,528	West Germany 14,716; Italy 8,379; Austria 5,366.

NA Not available.

[1] Owing to the lack of official data published by Czechoslovakia, this table should not be taken as a complete presentation of Czechoslovakia's mineral exports. Unless otherwise specified, data are compiled from trade statistics of individual trading partners, as well as the United Nations World Trade Annual, Walker and Co., New York.

[2] United Nations. Quarterly Bulletin of Steel Statistics for Europe, New York.

[3] Statistical Yearbook of the Member States of the Council for Mutual Economic Assistance, Moscow.

[4] Official trade statistics of Czechoslovakia.

[5] Less than 1/2 unit.

Table 3.—Czechoslovakia: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite[3] thousand tons	481	456	Hungary 330; Yugoslavia 126.
Oxide and hyroxide	29,494	25,836	Yugoslavia 16,112; Hungary 9,624.
Metal including alloys:			
Scrap	925	541	All from Austria.
Unwrought[3] thousand tons	88	95	U.S.S.R. 70; Hungary 12; Yugoslavia 9.
Semimanufactures	22,110	20,662	Yugoslavia 15,828; Hungary 3,400.
Cadmium metal including alloys, all forms[3]	279	369	Japan 95; United Kingdom 76; Yugoslavia 62.
Chromium:			
Chromite[3] thousand tons	156	180	U.S.S.R. 124; Albania 30.
Oxides and hydroxides	600	502	U.S.S.R. 500.
Cobalt:			
Oxides and hydroxides	21	16	United Kingdom 11; France 3.
Metal including alloys, all forms	--	8	All from France.
Copper:			
Ore and concentrate	--	4,115	Belgium-Luxembourg 2,795; Peru 1,320[5].
Metal including alloys:			
Scrap	692	332	All from West Germany.
Unwrought[2] thousand tons	58	56	U.S.S.R. 39; Poland 14.
Semimanufactures	17,242	24,462	West Germany 12,267; Poland 7,803.
Iron and steel:			
Ore and concentrate[3] thousand tons	15,970	15,600	U.S.S.R. 13,135; Brazil 991; Sweden 508.
Metal:			
Scrap do	44	49	West Germany 46.
Pig iron[3] do	833	919	U.S.S.R. 906.
Ferroalloys do	2	5	West Germany 3; Sweden 2.
Steel, primary forms do	[4]86	[4]98	NA.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	[4]166	[4]174	Poland 81; Yugoslavia 10.
Plates and sheets do	[4]135	[4]190	Bulgaria 24; West Germany 13.
Hoop and strip do	13	[4]13	Austria 2; West Germany 2.
Rails and accessories do	[4]5	[4]8	NA.
Wire do	3	[4]3	West Germany 1; Italy 1.
Tubes, pipes, fittings do	[4]99	[4]164	West Germany 112; Italy 30.
Castings and forgings do	16	[4]21	Hungary 3; Poland 1.
Lead:			
Ore and concentrate	--	1,949	All from Yugoslavia.
Oxide	12,724	3,748	Austria 1,754; France 1,602.

See footnotes at end of table.

Table 3.—Czechoslovakia: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Lead —Continued			
Metal including alloys:			
Unwrought[3] thousand tons	35	39	U.S.S.R. 22; Yugoslavia 9.
Semimanufactures	8	2	All from Yugoslavia.
Magnesium metal including alloys, all forms	--	2	All from West Germany.
Manganese ore and concentrate[3] thousand tons	1,324	526	U.S.S.R. 370; Australia 64; Brazil 43.
Molybdenum:			
Ore and concentrate	402	630	Netherlands 484; Belgium-Luxembourg 115.
Metal including alloys, all forms	2	1	Mainly from United States.
Nickel metal including alloys:			
Unwrought[3]	6,270	4,862	U.S.S.R. 4,068; Cuba 404; United Kingdom 390.
Semimanufactures	8	35	West Germany 18; United Kingdom 10.
Platinum-group silver and metals, unworked or partly worked:			
Platinum-group metals value, thousands	$3,701	$860	Italy $387; United Kingdom $281.
Silver do	$1,438	$13,373	Netherlands $10,890; Yugoslavia $2,209.
Tin metal including alloy; unwrought[3]	3,196	3,894	United Kingdom 1,278; Bolivia 797; Indonesia 600.
Titanium oxides	538	1,554	United Kingdom 848; West Germany 508.
Tungsten:			
Ore and concentrate	220	362	Netherlands 291.
Metal including alloys, all forms	3	2	All from Japan.
Zinc:			
Oxide and peroxide	162	240	All from United Kingdom.
Metal including alloys:			
Scrap	--	198	All from Yugoslavia.
Blue powder	4,839	--	
Unwrought[3] thousand tons	58	68	Yugoslavia 25; U.S.S.R. 21.
Semimanufactures	150	5,872	Yugoslavia 4,566.
Zirconium ore and concentrate	1,355	599	All from West Germany.
Other:			
Ores and concentrates	2,019	122,804	Brazil 64,551; Norway 57,654.
Oxides, hydroxides, peroxides of metals	222	529	West Germany 376; Finland 100.
Metals:			
Metalloids	1,399	74,018	West Germany 40,104; Austria 26,931.
Base metals including alloys, all forms	240	202	Japan 95; Finland 60; Austria 28.
Nonferrous metals including alloys, rolled[3]	8,350	967	NA.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc	830	828	Italy 678; Belgium-Luxembourg 135.
Dust and powder of natural or synthetic precious and semiprecious stones value, thousands	--	$3	United States $2.
Grinding and polishing wheels and stones	687	505	West Germany 192; Austria 174.
Asbestos[3]	1,685	44,028	U.S.S.R. 32,757.
Barite and witherite	--	100	All from West Germany.
Boron:			
Crude natural borates	492	10,390	Turkey 10,300.
Oxide and acid	1,117	3,436	France 1,265; Turkey 970; West Germany 476.
Cement[3] thousand tons	383	555	U.S.S.R. 369; Romania 125.
Chalk	157	355	Austria 195; France 85.
Clays and clay products:			
Crude:			
Fuller's earth and chamotte	--	58	All from Austria.
Kaolin	5,499	5,022	All from Hungary.
Other	1,200	984	West Germany 463; United Kingdom 408.
Products:			
Refractory	10,970	18,479	Austria 5,778; West Germany 4,919; Poland 4,507.
Nonrefractory	2,910	2,202	Italy 1,935.
Diamond:			
Gem, not set or strung value, thousands	$1,168	$989	United Kingdom $896.
Industrial do	$1,970	$4,008	Belgium-Luxembourg $3,159; Switzerland $842.
Diatomite and other infusorial earth	1,916	1,133	Iceland 1,091.
Feldspar and fluorspar	1,327	9,412	Kenya 5,858; West Germany 1,545; Poland 1,209.
Fertilizer materials:			
Crude:			
Nitrogenous	--	227	All from Bulgaria.
Phosphatic, P_2O_5 content[3] thousand tons	348	317	U.S.S.R. 160; Morocco 60; Tunisia 47.
Manufactured:			
Nitrogenous, N_2 content[3] do	45	59	All from U.S.S.R.

See footnotes at end of table.

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Table 3.—Czechoslovakia: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Fertilizer materials —Continued			
Manufactured —Continued			
Phosphatic, P_2O_5 content do.	[5]21	[5]57	Austria 5; United States 4.
Potassic, K_2O equivalent[2] do.	627	670	Poland 531; U.S.S.R. 138.
Ammonia	2,567	2,796	All from Hungary.
Graphite, natural	263	233	West Germany 219.
Gypsum and plasters[3] thousand tons	26	24	East Germany 23.
Lime	3,464	54	West Germany 40.
Magnesite	1,613	2,668	Greece 1,646; West Germany 412.
Mica:			
Crude, including waste	--	361	All from France.
Worked	8	21	Austria 17.
Pigments mineral: Iron oxides, processed	819	1,145	West Germany 921.
Precious and semiprecious stones value, thousands	$104	$214	West Germany $106; Switzerland $71.
Salt	153,874	130,177	U.S.S.R. 118,738.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	[5]3,800	[5]2,400	NA.
Soda ash[2] thousand tons	171	161	East Germany 66; Romania 47; Bulgaria 26.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	16,187	14,366	Yugoslavia 14,181.
Worked	442	303	Yugoslavia 300.
Dolomite	--	109	All from West Germany.
Gravel and crushed rock	17,774	6,848	Hungary 5,290; France 935.
Limestone	1,836	176	All from East Germany.
Quartz and quartzite	4,716	5,543	All from West Germany.
Sand, excluding metal bearing	989	5,496	Hungary 5,096.
Sulfur:			
Elemental:			
Other than colloidal[3] thousand tons	422	456	Poland 420.
Colloidal	214	147	Italy 84; West Germany 63.
Sulfuric acid[3]	46,734	59,726	Poland 58,660.
Talc	100	168	West Germany 81; Finland 50.
Other:			
Crude	7,844	8,172	Hungary 6,365; West Germany 1,051.
Slag, dross, similar waste	6,109	60	All from Netherlands.
Oxides and hydroxides of magnesium, strontium, barium	485	26	West Germany 23.
Halogens	23	10	France 7.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	61	All from West Germany.
Carbon black[3]	32,969	32,639	Romania 14,443; U.S.S.R. 11,728.
Coal and briquets:[3]			
Anthracite and bituminous coal thousand tons	5,619	5,591	U.S.S.R. 3,179; Poland 2,412.
Lignite and lignite briquets do.	318	466	East Germany 387.
Coke and semicoke do.	[5]55	36	NA.
Gas, natural[2] million cubic feet	182,395	202,952	U.S.S.R. 202,246.
Peat and peat briquets	--	23	All from West Germany.
Petroleum:			
Crude[2] thousand 42-gallon barrels	134,640	136,530	U.S.S.R. 130,183; Iran 1,216; Iraq 1,110.
Refinery products:			
Gasoline do.	[5]1,573	[5]1,590	NA.
Kerosine do.	16	50	West Germany 47.
Distillate fuel oil do.	[5]4,513	[5]4,036	NA.
Residual fuel oil do.	475	628	West Germany 390; Austria 198.
Lubricants do.	311	320	Austria 286.
Other:			
Liquefied petroleum gas do.	20	80	Austria 77.
Mineral jelly and wax do.	15	16	West Germany 10.
Petroleum coke do.	66	83	All from West Germany.
Bitumen and other residues do.	31	5	All from Austria.
Bituminous mixtures do.	--	1	Mainly from Austria.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	939	602	West Germany 388; Netherlands 184.

NA Not available.

[1] Owing to the lack of official trade data published by Czechoslovakia, this table should not be taken as a complete presentation of Czechoslovakia's mineral imports. Unless otherwise specified, data are compiled from trade statistics of individual trading partners, as well as the United Nations World Trade Annual, Walker and Co., New York.

[2] Official trade statistics of Czechoslovakia.

[3] Metallstatistik (Metallgesellschaft) 1968-1978. Druckerei C. Adelmann, Frankfurt am Main, 1979.

[4] United Nations. Quarterly Bulletin of Steel Statistics for Europe. New York.

[5] Statistical Yearbook of the Member States of the Council for Mutual Economic Assistance, Moscow.

COMMODITY REVIEW

METALS

Aluminum.—The lack of aluminum raw material reserves in Czechoslovakia created a dependence on imports of bauxite and alumina.

Czechoslovakia's aluminum reduction plant, with an estimated capacity of 60,000 tons, is located at Ziar nad Hronom in Central Slovakia. Ziar operates on imported bauxite from Hungary. In 1978-79 the plant produced alumina, aluminum, and some aluminum products. Production was below the estimated capacity of the plant. Aluminum and special alloys from scrap were also produced at plants in North Moravia and Central Bohemia. Capacity of the Kovohute Bridlica manufacturing plant is estimated at 10,000 tons of foil and 26,000 tons of strip.

Antimony.—In 1978-79 antimony ores were mined in the Low Tatras in Slovakia and near Bratislava at Pezinok. Plans through 1990 emphasize the need to modernize and increase existing mining and ore processing facilities. Czechoslovakia expects to export antimony by 1990. Resources of antimony ore are mostly limited to the deposits situated in Slovakia, where extraction is also to be concentrated in the future. Czech production, especially in Krasna Hora where drilling was done in 1978 around Sedlcany and Pricov, could cover some part of antimony consumption. The known antimony deposits in th Czech Massiv are of a vein type with great uncertainty of mineralization.[25]

Copper.—Production of copper in 1979 was approximately the same as in 1978 and in 1977. Imports of copper metal from the U.S.S.R. and Poland supplied the main requirements of Czechoslovak industry consumption. Present Czechoslovak copper consumption is approximately 85,000 tons per year.

Under a long-term agreement, Czechoslovakia participated in the development of copper production at Lubin mines in Poland. In 1978-79 copper ores were mined in conjunction with iron ores at Rudnany (Slovakia) and near Roznava (Slovakia), copper-lead-zinc ores in Banska Stiavnica (Slovakia), and copper ores in the Zlate Hory (Moravia). Copper mining is to be expanded. Slovakia appears to have good prospects regarding copper mining.

The new copper-lead-zinc deposits were found in Zlata Bana, Roznava, Novoveska Huta, Slovinky, and Gelnica in 1978.[26] It is believed that Slovakia will be able to provide 16% of the country's needs of copper in the future.

Gold.—A new study of gold deposits was made by the Geoindustria enterprise of Prague. It is expected that new technologies will make it possible to process very lean ores, so that they meet much of the long-term home demand. It was found that what used to be regarded as copper, lead, and zinc deposits in the Jeseniky Mountains are in fact the country's biggest gold deposits as the value of gold far exceeds that of the other metals. Estimated metal content is 3 grams per ton of gold-bearing ore.[27]

Iron and Steel.—Iron ore deposits in Czechoslovakia occur in different areas, however, only deposits in Central Czechoslovakia and in the Slovak Ore Mountains are economically important. In 1978-79 iron ore was mainly extracted from the Rudnany mines, located in Slovakia. Domestic production supplied only a small part of the country's requirement of iron ore, and the main part of the ore was imported from U.S.S.R. The rest of the ore was imported from Brazil, Sweden, India, and Algeria. Czech participation in the construction of the Soviet Union's ore projects in the Ukraine and Kursk Magnetit Anomaly is planned to cover rising domestic requirements.

It is estimated that total reserves of iron ore in Czechoslovakia approximate 500 million tons with average metal content of about 30%. Steel scrap is the most important domestic raw material for steel production of which nearly 8 million tons were available in 1978.[28] Steel scrap accounted for more than 50% of steel production. About 40% of the processed steel scrap comes from the Prumysl Kovoveho Odpadru (Industry of Metal Scrap) enterprise and its Kovosrot subdivision. Investments in the iron and steel industry during 1978 totaled about Kcs5.7 billion.

The production of pig iron and steel in 1979 was below the 1978 level. It is anticipated that output of pig iron will reach 10.5 million tons in 1980 and 12.8 million tons in 1990. Crude steel production is planned to reach 16.3 million tons in 1980 and 20.4 million tons in 1990.

Czechoslovakia's plans for the steel industry are to reduce the open hearths production and to increase the oxygen converter output as shown, in percentage, in the following tabulation:

	1978	1980	1985
Open hearth	62	32	15
Electric	12	14	15
Oxygen	26	54	70
	100	100	100

The main aim of capital investment in the Czechoslovakian iron and steel industry in the 1976-80 period is to promote a more substantial change in the structure of production and range of products. Faster growth is planned for pipes, rolled products, alloyed and stainless steels, and specifically for a wider assortment of pipes.

The pipe program provides for a major increase in production of precision steel cold-formed pipes and oil pipes under a protocol on cooperation between the Governments of Czechoslovakia and the Soviet Union and involves the corporations Poldi Kladno, (SONR), Chomutov (VTZ), Ostrava-Kunice (NHKG), Podbrezova (SZ), and a few others.[29]

One of the largest capital investment projects in the Czechoslovak ferrous industry, the new pipe plant with a cost of more than Kcs1,800 million, was put into operation in 1979. It is a part of the Svermovy Zelezarny complex at Podbrezova (Slovakia).[30]

A new continuous casting machine with a capacity of 0.2 million tons per year was put into operation at the United Steel Works at Kladno in 1978. The construction of billet and blooming mills at Kladno continued in 1978 and 1979 and is expected to be the major project for 1980. When the whole project at Kladno is completed, the complex is reportedly to be capable of producing 1.2 million tons of steel per year.[31]

Expansion of manufacturing facilities at the Chomutov pipe plant was underway in 1978 and 1979, but progress of construction was hampered by delay in deliveries of imported technological equipment.[32]

Renovation and expansion of the new Klement Gottwald steel plant continued in 1979. The new capacity of the enterprise is expected to be 4.2 million tons of steel per year.

At the East Slovak Iron and Steel Complex at Kosice, the No. 2 blast furnace was put into operation in November 1979. A reduction is expected in coke consumption of 45 kilograms per ton of pig iron production. The complex accounts for one-third of the country's production of pig iron. Construction of the new No. 5, 25-ton electric furnace started in the metallurgical section of the Skoda enterprise in 1979, and replacement of an old open-hearth furnace by a new one is planned for 1980.

Lead and Zinc.—In 1978-79 lead-zinc ore continued to be mined at Pribram and Kutna Hora (Central Bohemia), Horni Beneso (Moravia), and Banska Stiavnica (Central Slovakia). About 70% of the total lead-zinc ore came from Czech deposits and some 30% from Slovakia deposits.

Production of lead and zinc is far below demand, and they continued to be imported mainly from Yugoslavia and the U.S.S.R. A substantial increase in lead-zinc production is expected after 1985. New investments are planned for Zlate Hory to develop deeper levels of the copper-lead-zinc ore and at the Horni Benesov deposits.[33]

Mercury.—Mercury was extracted from deposits at Rudnany (Slovakia). Over the 10 years of its existence, the mercury plant at Zeleznorudnedoly Rudnany produced 1.86 million kilograms of technically pure mercury. Czechoslovakia began to process the concentrate in 1969, and the country's economy became independent of mercury imports.[34]

Silver.—The rich deposits of silver have been largely depleted. The remaining deposits of Jihlava, Kutna Hora, Stribro, and Jachymov in Bohemia, and of Kremnica and Banska Stiavnica in Slovakia, are of little economic significance. The largest share of Czechoslovakia's total silver production is recovered as a byproduct from processing of polymetallic ores.

In 1978-79, domestic mines contributed a small percent of the silver used in the country. The further development of silver production in Czechoslovakia is to be concentrated on polymetallic ores and on the metallic Jochimov formations containing proustite (Ag_3AsS_3—silver arsenic sulfide).

Production of bismuth, cobalt, and nickel from Jochimov polymetallic ores could make production of silver mining economical.

The Svornost and Kovnost mines (Jochimov area) are the main potential producers of silver for the future. Silver minerals are known also in some polymetallic veins in the Pribram area (Vzancice, Radetice, and nearby), but their importance is small and the economy of production is highly problematical.[35]

Tin.—Tin ores were mined at Cinovec (North Bohemian region) and at the Horni Slovak (West Bohemian region). A new deposit of tin dioxide (SnO_2) has been discovered in significant quantity in Slovakia near Medvedi Brook, in the vicinity of the Hnilec village. The resources are estimated at 2 million tons of tin ore. According to Czechoslovak sources, there are more promising deposits of tin ores in the area of the Hnilec River.[36]

Uranium.—Czechoslovakia's proved reserves and production of uranium ore are substantial. Most of the uranium oxide production is exported to the U.S.S.R. The Soviet Union has total control of the exploration and production of uranium in Czechoslovakia. Data on uranium ore production are practically nonexistent, because such information is classified. Uranium production is centrally controlled and is headed by the Czechoslovak Uranium Industry (CSUP).

In 1978-79, the main mining areas included Hamar-na Jezere, Dolni Rozinka, Slovakov, Trutnov, Zodni Chador, Spisska Nova Ves, and Pribram. Major investment was underway in Pribram and North Bohemia. Ore concentration plants were located in Dolni Rozinka and Mudlovary. A new uranium ore dressing plant was put into operation in Straz pod Ralskem in the Ciska Lipa district in 1978. It will be one of the main dressing plants in the Czechoslovak uranium industry and will process uranium ore from North Bohemia. In 1978, shaft No. 19 of the Pribram uranium mine was being sunk. In 1979, the Pribram mine was extracting uranium ore from a depth of 1,480 meters.[37]

NONMETALS

Cement.—Czechoslovakia is an importer of cement. In 1978-79 cement was imported mostly from the U.S.S.R., Romania, and the German Democratic Republic.

The construction of the new cement plant at Prachovice with a capacity of 1.2 million tons of cement per year was in progress in 1978, and the trial operation started on April 1, 1979. Construction of this cement plant started in 1974, and cost was estimated at Kcs2.0 billion.[38] Cement plants at Turna, Cizkovice, and Rohoznik were also under construction in 1978-79. There are plans for construction of the Kraluv Dvur cement plant with a total capacity of 6,000 tons per day.

Fertilizers.—In 1978, official consumption of fertilizer per hectare of agricultural land was over 240 kilograms in nutrient content. Czechoslovakia is to use 268 kilograms per hectare by 1980 and about 320 kilograms by 1985. Production of nitrogen and phosphate fertilizers provides approximately 65% of the country's consumption.

While some urea was exported, Czechoslovakia imported significant amounts of fertilizer raw materials and maufactured fertilizers in 1978-79.

The production of manufactured fertilizers was planned to be developed further under the sixth 5-year plan (1976-80); however, the construction of new facilities is not anticipated. In 1978-79, emphasis was placed on better utilization of the existing facilities, intensification of production processes, and an increase of average nutrient content.

In 1978 and 1979, Czechoslovakia continued to make an urea-ammonium nitrate solution, DAM-390, at the pilot plant at Dusla Natinal Enterprise in Sala at the rate of more than 20,000 tons per year.[39]

The output of liquid fertilizer is to be expanded further under the next 5-year plan (1981-85). The output is to reach about 150,000 tons in 1981 and 600,000 tons in 1987.

Renovation of some of the plants for complex fertilizers is also expected under the new 5-year plan (1981-85). The situation is especially complicated regarding phosphate fertilizers because Czechoslovakia relies entirely on imports of material and cannot expect increased Soviet deliveries in the future. A new trend agreement between Jordan and Czechoslovakia was signed on May 27, 1979. The Czech will buy phosphate fertilizers from Jordan Fertilizer Industry Co., which is due to start production at Aqaba in 1981. In 1978 negotiations were held in Vietnam on the feasibility of mining local phosphate deposits, building phosphorus plants, and importing phosphate fertilizers from Vietnam in the future. Negotiations were also underway with Mongolia for joint utilization of recently discovered phosphate deposits.[40]

Fluorspar.—Domestic fluorite output remained inadequate to meet the demand, and about three-fourths of the consumption was met by imports in 1978 and 1979. The main center for fluorite production continued to be Sobedruby, located in the Ore Mountains in North Bohemia, which produces fluorite in the form of concentrates.

Since 1975, the mine and processing plant have been renovated and enlarged. Reportedly, recently discovered fluorspar deposits in the Ore Mountains will help to make Czechoslovakia self-sufficient in fluorite after 1985.

Kaolin.—There are large deposits of high-quality kaolin in Czechoslovakia. The deposits of kaolin near Karlovy Vary are reported to be sufficient to last until 1995, the Pizensky deposits, until 2020, and the Podbarany kaolins, until 2100.

The deposits near Karlovy Vary contain 25% to 35% of pure kaolin, and the Pizensky deposits about 13% to 14%. Mining at the Karlovy Vary areas is planned to go much deeper after 1980. In 1979, Czechoslovakia exported China clay to many countries including the Federal Republic of Germany, Poland, Austria, Yugoslavia, Hungary, the Netherlands, the German Democratic Republic, Sweden, and others.

New washing facilities for paper and ceramic kaolins have been built recently at the Kaznejov and Bozicany plants. The plant at Velke Opatovice has expanded its manufacturing capacity by the construction of new facilities for dressing and storing clays at its branch in Brnik.

The plant at Sadov was also renovated, the output of paper kaolin was expanded, and it is planned to enlarge the washing facilities. Renovation of the Hlubany plant was underway in 1978.[41]

Magnesite.—In 1978-79 production of magnesite fully covered the consumption of the country, and magnesite was exported mainly to Hungary, Poland, the German Democratic Republic, Romania, and the Federal Republic of Germany.

Lavinobana and other places in Central and Eastern Slovakia are important magnesite mining and processing centers. Along with the growth of the output of Slovenske Magnezitive Zavody at Kosice (Eastern Slovakia), the exports through Kerametal Bratislava were also increasing. Slovenske Magnizitove Zavody exported about one-half of its output. Czechoslovakia has been developing and renovating magnesite mines. It is planned to increase the capacities of the mines approximately to 0.1 to 0.5 million tons per year and to decrease the number of small mines in the near future. The plans also call for the rapid completion of facilities for manufacturing refractory products.[42]

Sulfur.—In 1978 a sulfuric acid plant at Prerov and a 40,000-ton-per-year phosphoric acid plant at Postorna were brought onstream. The capacity of the Prerov sulfuric acid plant is 600 tons per day.

MINERAL FUELS

Total energy production derived from fossils and from hydroelectric and nuclear electric power generation was 88.4 million tons standard coal equivalent (SCE) in 1979, with coal, including lignite, supplying 98%. Total consumption of primary energy was over 127 million tons SCE with coal providing about 67%, oil 23%, natural gas 9%, and hydroelectric power, nuclear power, and imported electric power less than 1% each. The primary energy balance of Czechoslovakia for 1978 and 1979 is shown in the table.

Table 4.—Czechoslovakia: Total primary energy balance for 1978 and 1979

(Million tons of standard coal equivalent)[1]

	Total primary energy	Coal (bituminous, brown, and lignite) and coke	Crude oil and petroleum products	Natural gas	Hydroelectric power	Nuclear power	Turnover of electrical energy
1979:							
Production	88.4	86.3	0.2	1.1	0.5	0.3	--
Imports	46.2	5.9	30.0	9.8	--	--	0.5
Exports	77.3	6.4	.8	--	--	--	.1
Apparent consumption	127.3	85.5	29.4	10.9	.5	.3	.4
1978:							
Production	87.0	85.2	.2	1.0	.5	.1	--
Imports	44.7	5.8	28.8	9.7	--	--	.4
Exports	7.1	6.1	.8	--	--	--	.1
Apparent consumption	124.6	84.8	28.2	10.7	.5	.1	.3

[1] 1 ton of standard coal equivalent (SCE)=7 million kilocalories. Conversion factors used are as follows: Hard coal, 1.0; brown coal and lignite, 0.6; crude oil, 1.47; natural gas (1,000 cubic meters), 1.33; hydroelectric and nuclear power (1,000 kilowatt-hours), 0.125.

Sources: Statistical Yearbook of Czechoslovakia, Prague, 1979; Statisticke Prehledy (Statistic Summary), Prague, No. 2, 1980, p. 42.

Coal.—Output of bituminous coal in 1980 and in the long run is expected to remain at approximately the same level as in 1978 and 1979. The Ostrava-Karvina coal basin supplied more than 85% of Czechoslovakia bituminous coal mined in 1978 and 1979; Kladno basin supplied about 8%, and the Plzen, Trutnow and Rosice basins about 7%. More than 65% of bituminous coal produced was of metallurgical quality. Deep coal mining of bituminous coal in Czechoslovakia meets demand for coking coal for the domestic industry as well as for export.

There were some 16 mines in the Ostrava-Karvina bituminous coal basin, and 2 mines were under development in 1978 and 1979. The average depth of mining was about 600 meters; worked seam thickness ranged from 0.5 to 3-4 meters; however, a considerable part of the reserves at the Ostrava-Karvina coalfield is formed by seams from 0.5 meter to 0.7 meter. Coal was mined under increasingly more difficult conditions in 1978 and 1979; therefore, scientific and technological research was directed towards working of thin seams and towards difficult mining conditions at depths of about 1,000 meters.[43]

The Darkov mine with a projected annual capacity of 5 million tons was the largest capital investment in the Ostrava-Karvina coal basin in 1978 and in 1979.[44] There is a total of 1.7 billion tons of hard coal, wich can be extracted from the Ostrava-Karvina coalfield and other areas, but geological surveys of other deposits have not yet been completed. The reserves should last 50 to 60 years at the present rate of production.

During the seventh 5-year plan (1981-85) in the Kladno Mining Concern development is to begin on the Slany and Chotikov mines and continue on the Frenstat and Pribor mines of the Podbesky region and on the Darkov mine. In 1979, a contract was signed between the Czechoslovak foreign trade company Metalimex and the U.S.S.R. for the supply of 3.2 million tons of hard coal to Czechoslovakia in 1980.

Brown coal and lignite output is planned to reach 98.5 million tons in 1980 and 106 million tons in 1985. The North Bohemian basin is to supply the largest part (68.2 million tons) of the brown coal production in 1980. In 1978, about 73% of brown coal came from the North Bohemian basin, about 23% from the Sokolow basin, and the remainder from the Kandlova and Mody Kamen basins.

The North Bohemian coal district is the only so-called developing district in Czechoslovakia. It is to meet 44% of all energy needs of the country in 1980 and about 37% in 1990. However, the North Bohemian brown coal basin did not fulfill 1978 and 1979 plan targets. This underfulfillment of year plans in production of brown coal was concentrated primarily at the Maxim Gorky and Czechoslovak Army large open pit mines. The unreliable operation of technological units was the chief reason for this situation. The plan of the overburden removal was fulfilled 92.4% in 1979. The prospects for increasing the brown coal output in the future were therefore not particularly good.

In 1978 and 1979 development was continued on the large, 6-million-ton-annual-capacity Vrsany surface mine near Most. The Vrsany mine was scheduled to come into operation in 1982 and is to supply coal to the Pocerdany electric powerplant. Development of a new brown coal mine with projected capacity of 15 million tons per year at Miculcice, near Hodonin, started in 1979, and production is scheduled to begin in 1982. This project is estimated at Kcs894 million.[45] The development of the new brown coal strip mine, Erika, with annual capacity of 1 million tons of brown coal was completed in the Socolov brown coal basin in 1978.

During the seventh 5-year plan (1981-85) renovation of the Czechoslovak Army, Sverma, Mercur Bruzno, and other mines is planned, but the most important development is planned for the Maxim Gorky open pit mine. Resources of brown coal and lignite are sufficient for another 40 to 50 years, if annual production is maintained at about 100 million tons. Reserves in the North Bohemian field are estimated at 5.9 billion tons. Present technology permits the extraction of less than 40% of the reserves, but this is to be raised to more than 60%. There is also 640 million tons of brown coal in the Sokolov field in Northern Bohemia and 275 million in Slovakia.

Natural Gas.—The extraction of natural gas in Czechoslovakia is insignificant. Most gasfields discovered during the 1970's have been very small. The U.S.S.R. supplied all of Czechoslovakia's gas imports in 1978 and 1979.

The two transit pipelines (each of 1,120 kilometers), carrying 26,000 million cubic meters of Soviet natural gas per year through Czechoslovakia, were in operation in 1978 and 1979. In July 1978, work started on the construction of the third transit

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pipeline. This line, with an annual capacity of 16 billion cubic meters, will convey natural gas from the Soviet Union to Central and Western Europe; 3.6 billion cubic meters will be shipped to Czechoslovakia. On completion of this gas pipeline (the Consorcium), the transit system will have an approximate total length of 3,150 kilometers. By 1984, it is to transport 53 billion cubic meters of gas annually, under a trade agreement with the U.S.S.R., Czechoslovakia is scheduled to acquire more than 8 billion cubic meters of their gas.[46]

Construction of the Soyuz gas pipeline, which runs from Orenburg in the southern Urals to the western borders of the U.S.S.R., was completed in 1979, and 2.8 billion cubic meters of gas is to be delivered to Czechoslovakia through this line in 1980.

Petroleum.—Production of crude oil in Czechoslovakia is insignificant and is concentrated in South Moravia and Slovakia. The U.S.S.R. provided about 94% of Czechoslovakia oil imports in 1979. Under a contract signed in Prague on January 25, 1980, 19.2 million tons of crude oil and petroleum products are to be imported from the U.S.S.R. in 1980. The total value of the contract is R1,125 million. The Adriatic line is expected to be operational in 1980,[47] when Czechoslovakia is to receive some 5 million tons of crude oil per year from Africa and the Middle East. The 735-kilometer Adriatic Pipeline will run from the Yugoslavian port of Omisalj on the island of Krk through Yugoslavia and Hungary to Czechoslovakia. Czechoslovakia contributed to the construction of the Adriatic pipeline with a credit of $25 million, in return for which the country is to be able to use the pipeline.[48]

Since the beginning of February 1962, when the Druzhba oil pipeline went into operation, until the end of 1978, this pipeline has carried more than 170 million tons of crude oil to Czechoslovakia. The Soviet crude oil is refined and processed at five refineries in Czechoslovakia into more than 260 refinery products and over 5,000 petrochemical items. Refining capacity on January 1, 1978, was estimated at approximately 20 million tons per year. The Slovnaft combine in Bratislava, the largest and most modern refinery and petrochemical complex in Czechoslovakia, is to process 9 million tons of crude oil in 1980, 85,000 tons more than in 1979.[49]

In the 1975-78 period, the Chemapol plant in Kralupy processed 9 million tons of Soviet crude oil. The plant, which is directly connected to the Druzhba oil pipeline, produces gasoline, diesel, heating oil, and other products.

A new refinery for the processing of Soviet crude went onstream at Vajany near Kosice in Slovakia in 1978. The planned production of this refinery for 1980 is 1.5 to 2 million tons.

The Czechoslovak refining industry is to be capable of processing 21 million tons of crude oil in 1980: 9 million tons in the Bratislava Slovnaft enterprise, approximately 6 million tons in Litvinov, 3 million tons at Kralupy, 1.5 million tons in Vojang, 1 million tons in Pardulice, 300,000 tons in Ostrava, and 200,000 tons in Kolin.

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[1] Foreign mineral specialist, Branch of Foreign Data.

[2] Includes the following countries: Bulgaria, Cuba, Czechoslovakia, German Democratic Republic, Hungary, Mongolia, Poland, Romania, the U.S.S.R., and Vietnam.

[3] Foreign Trade (Prague). No. 4, 1979, p. 42.

[4] Revue Obchodu Prumyslu Hospodarstvi (Trade Review of Industrial Economics) (Prague). No. 5, 1979, p. 42.

[5] Official exchange rate for Czechoslovak korunas (Kcs) to U.S. dollars was Kcs5.12=US$1.00 in 1978 and Kcs5.06=US$1.00 in 1979.

[6] Statisticke Prehledy (Prague). No. 3, 1979, p. 65.

[7] Rude Pravo. Aug. 15, 1979, p. 3.

[8] Hospodarske Noviny (Economic News) (Prague). Jan. 18, 1980, p. 2.

[9] Statisticke Rocenka Ceskoslovenske Socialisticke Republic (Statistical Annual of the Czechoslovak Socialist Republic) (Prague). 1979, p. 346.

[10] Czechoslovak Foreign Trade (Prague). No. 7, 1979, pp. 10-11.

[11] Rude Pravo. Jan. 15, 1980, pp. 1,2.

[12] Economical Cooperation of the CMEA Member Countries (Moscow). No. 6, 1979, p. 14.

[13] Foreign Trade (Moscow). No. 5, 1979, p. 16.

[14] Svet Hospodarstvi (World of Economics) (Prague). Nov. 9, 1978, pp. 1-2.

[15] Bratislava Pravda. Feb. 29, 1980, p. 2.

[16] Czechoslovak Foreign Trade (Prague). No. 1, 1980, p. 8.

[17] Czechoslovak Foreign Trade (Prague). No. 1-2, 1979.

[18] Facts on Czechoslovak Foreign Trade. (Prague). 1979, p. 36.

[19] Czechoslovak Foreign Trade (Prague). No. 5, 1979, p. 44.

[20] Page 47 of work cited in footnote No. 3.

[21] Foreign Trade (Moscow). No. 3, 1980, p. 11.

[22] Czechoslovak Foreign Trade (Prague). No. 2, 1980, p. 47.

[23] Czechoslovakia Foreign Trade (Prague). No. 12, 1979, p. 39.

[24] Rude Pravo. Jan. 15, 1980, p. 6.

[25] Geologicky Pruzkum (Geological Survey) (Prague). No. 1, 1979, p. 2.

[26] Hornic and Energetic (Miner and Power Worker) (Prague). May 18, 1978, p. 3.

[27] Rude Pravo. Feb. 12, 1980, p. 3.

[28] Czechoslovak Foreign Trade (Prague). No. 8, 1979, p. 42.

[29] Page 34 of work cited in footnote 23.

[30] Page 42 of work cited in footnote 23.

[31] Svet Hospodarstvi (World of Economics) (Prague). Sept. 19, 1978, pp. 1-2.

[32] Hospodarske Noviny (Economic News) (Prague). Nov. 23, 1979, p. 2.

[33] Svet Hospodarstvi (Prague). Nov. 9, 1978, pp. 1-2.

[34] Page 45 of work cited in footnote 16.

[35] Page 4 of work cited in footnote 25.

[36] Lidova Democratic (People's Democracy) (Prague). July 15, 1978, p. 2.

[37] Page 46 of work cited in footnote 16.

[38] Czechoslovak Foreign Trade (Prague). No. 10, 1978, p. 2.

[39] Page 32 of work cited in footnote 19.

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[40] Svet Hospodarstvi (World of Economics) (Prague). Sept. 22, 1978, p. 2.

[41] Czechoslovak Foreign Trade (Prague). No. 11, 1978, p. 19.

[42] Work cited in footnote 30.

[43] Czechoslovak Heavy Industry (Prague). No. 8, 1979, p. 30.

[44] Lidova Democracie (People's Democracy) (Prague). Mar. 4, 1980, p. 3.

[45] Work cited in footnote 34.

[46] Czechoslovak Heavy Industry (Prague). No. 1, 1979, p. 23.

[47] Czechoslovak Heavy Industry (Prague). No. 10, 1979, p. 23.

[48] Rude Pravo. Nov. 29, 1979, p. 7.

[49] Bratislava Vecernic (Bratislava's Evening) (Bratislava). Feb. 19, 1980, p. 4.

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The Mineral Industry of Denmark and Greenland

By Joseph B. Huvos[1]

During 1978 and 1979, the economy of Denmark and Greenland was sluggish and was expected to remain so until the advent of a major international economic upturn. Balance of payments considerations resulted in a restrictive fiscal and monetary policy. Inflation was 11.4% and unemployment was 6.1%. The gross national product (GNP) of Denmark and Greenland, reported as a total, was about $54 billion.[2] [3] The Danish Kroner was devalued by 5% against the West German mark.

Denmark's small mineral resources, consisting of some North Sea oil, gas, diatomite, and Greenland's modest lead-zinc ore deposits, contributed little to the GNP.

Notable events included formation of a ferrous scrap company, Government approval of a $50 million loan to the sole Danish steel company, and formation of a Danish-West German joint oil enterprise. Greenland obtained through home-rule a veto power over mineral exploitation, and the island's offshore petroleum drilling ran at a reduced level.

DENMARK

PRODUCTION

Denmark's production of selected minerals and mineral products are shown for 1976, 1977, 1978, and 1979 in table 1.

Table 1.—Denmark: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978^p	1979^e
Cement, hydraulic[1]	2,355	2,309	2,627	2,700
Chalk[1]	89,719	124,133	110,939	NA
Clays: Kaolin, crude and washed[e] ... tons	23,000	23,000	23,000	20,000
Coke, gashouse ... do.	70	[e]70	NA	NA
Diatomaceous materials:[e]				
Diatomite	21	25	25	25
Moler	[r]230	230	230	180
Fertilizer materials, manufactured, gross weight:[1]				
Nitrogenous	59	86	69	NA
Phosphatic	548	428	547	NA
Mixed and unspecified	336	358	434	NA
Iron and steel:				
Iron ore (less than 42% Fe), gross weight	8	5	5	9
Crude steel[3]	722	686	863	[3]804
Semimanufactures	552	[e]560	646	NA
Lead metal including alloys, secondary[1]	19	23	21	31
Lime, agricultural, and quicklime[1]	231	173	162	160
Nitrogen: N content of ammonia	33,000	32,900	32,900	32,900
Peat, agricultural[1]	39	40	47	45
Petroleum:				
Crude ... thousand 42-gallon barrels	1,492	3,285	3,305	4,000

See footnotes at end of table.

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Table 1.—Denmark: Production of mineral commodities —Continued

(Thousand metric tons unless otherwise specified)

Commodity		1976	1977	1978[p]	1979[e]
Petroleum —Continued					
Refinery products:					
Gasoline	thousand 42-gallon barrels	11,863	11,942	12,045	NA
Jet fuel	do	1	72	32	NA
Kerosine	do	866	775	698	NA
Distillate fuel oil	do	[e]25,081	25,588	24,648	NA
Residual fuel oil	do	16,242	14,992	16,497	NA
Lubricants	do	30	--	--	NA
Unspecified	do	3,577	3,839	3,839	NA
Refinery fuel and losses	do	3,615	4,465	4,465	NA
Total	do	61,275	61,674	62,224	NA
Salt[1]		349	314	325	NA
Sodium compounds: Sodium carbonate	tons	1,000	1,000	1,800	1,800
Stone, sand and gravel:[1]					
Dimension stone[5]	thousand cubic meters	35	39	48	NA
Crushed and broken stone:[6]					
Limestone:					
Agricultural	do	1,837	1,687	1,788	NA
Other	do	278	284	226	NA
Other	do	11	10	11	NA
Sand:					
Industrial	do	1,135	1,161	1,694	NA
Other	do	786	626	421	NA
Sulfur, byproduct		10	11	14	15

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] Data represent sales.

[2] Includes shipyard's production of steel castings.

[3] Reported figure.

[4] Excludes steel forgings.

[5] Granite and gneiss only; excludes an unreported quantity of other dimension stone with a sales value of $332,341 in 1976; $302,838 in 1977; NA in 1978; and NA in 1979.

[6] Partial figures; exclude an unreported quantity of quartz and quartzite with a sales value of $377,832 in 1976; $356,143 in 1977; NA in 1978; and NA in 1979.

TRADE

In 1978 and 1979, there was no significant change in Denmark's foreign mineral trade. Total mineral trade in 1977 and 1978 is shown in tables 2 and 3.

Table 2.—Denmark: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite and concentrate	13,720	41,561	United Kingdom 17,662; West Germany 6,827; Republic of South Africa 5,760; Finland 2,153.
Oxide and hydroxide	248	109	India 30; United Kingdom 24; France 19.
Metal including alloys:			
Unwrought and scrap	13,562	17,207	West Germany 11,198; Belgium-Luxembourg 2,137; Sweden 1,988.
Semimanufactures	12,052	12,459	Sweden 5,566; West Germany 1,797; Norway 802; United Kingdom 776.
Antimony metal including alloys, all forms	22	23	Finland 20; Colombia 2.
Chromium: Chromite	--	12	Belgium-Luxembourg 10.
Cobalt metal including alloys, all forms kilograms	100	--	
Copper metal including alloys:			
Scrap	11,120	12,499	West Germany 11,723; Sweden 338; United Kingdom 158.
Unwrought	1,012	882	Sweden 564; West Germany 314.
Semimanufactures	5,757	9,246	United Kingdom 1,651; Sweden 1,494; France 933.
Iron and steel:			
Ore and concentrate	4,763	10,323	West Germany 6,596; Netherlands 1,800; United Kingdom 1,480.
Roasted pyrite	--	608	All to West Germany.
Metal:			
Scrap	57,006	81,430	West Germany 55,325; United Kingdom 7,131; Norway 6,902; German Democratic Republic 5,071.
Pig iron, including cast iron	411	100	Sweden 80; West Germany 14.
Sponge iron, powder, shot	--	118	West Germany 106; Sweden 4.

See footnotes at end of table.

Table 2.—Denmark: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Ferroalloys	--	NA	
Steel, primary forms	9,233	3,076	United Kingdom 1,508; Sweden 690; Norway 410.
Semimanufactures:			
Bars, rods, angles, shapes, sections	94,532	106,031	West Germany 44,862; Sweden 29,791; United Kingdom 10,136.
Universals, plates, sheets	309,553	374,950	West Germany 94,531; Sweden 93,762; Norway 46,920.
Hoop and strip	14,589	16,428	Sweden 14,238; West Germany 1,224.
Rails and accessories	1,744	7,740	Thailand 5,021; Italy 2,264; West Germany 384.
Wire	5,244	5,098	Sweden 1,846; Norway 919; Finland 736.
Tubes, pipes, fittings	36,348	41,440	Sweden 24,989; West Germany 5,542; Norway 1,720.
Castings and forgings, rough	16,141	16,008	Sweden 5,860; West Germany 5,137; Norway 1,652.
Total	478,151	567,695	
Lead:			
Ore and concentrate	600	580	NA.
Oxide	43	47	Saudi Arabia 25; West Germany 10; United Kingdom 6.
Metal including alloys:			
Scrap	1,189	801	West Germany 551; Sweden 205; Netherlands 47.
Unwrought	18,354	17,962	Netherlands 7,151; Norway 3,895; Austria 2,692.
Semimanufactures	318	430	Finland 330; West Germany 28.
Magnesium metal including alloys, all forms	136	187	West Germany 137; Yugoslavia 45.
Manganese oxide	211	235	Sweden 234.
Mercury 76-pound flasks	29	75	United Kingdom 41; West Germany 32.
Molybdenum metal including alloys, all forms	3	2	All to West Germany.
Nickel metal including alloys, all forms	131	75	West Germany 43; Sweden 13; United Kingdom 8.
Platinum-group metals and silver:			
Waste and sweepings thousand troy ounces	1,771	1,752	United Kingdom 1,071; Sweden 266; Norway 193; West Germany 178.
Metals including alloys:			
Platinum-group do	(1)	1	Mainly to Sweden.
Silver do	560	884	Sweden 365; Finland 166; Norway 129; Netherlands 118.
Tin metal including alloys:			
Unwrought	1,026	660	United Kingdom 186; Italy 121; Norway 108; Sweden 43.
Semimanufactures	177	177	Norway 53; Sweden 49; Iraq 18; Hungary 13.
Titanium dioxide	410	177	Sweden 126; Finland 26; West Germany 16.
Zinc:			
Oxide	232	27	Sweden 10; Kuwait 5; United Arab Emirates 5.
Metal including alloys:			
Scrap, including blue powder (dust)	3,684	4,455	West Germany 2,347; Belgium-Luxembourg 559; Netherlands 553; Norway 442.
Unwrought and semimanufactures	1,004	225	Sweden 130; Venezuela 25; West Germany 24.
Other:			
Ash and residue containing nonferrous metals	5,521	5,166	West Germany 2,370; Norway 1,018; Sweden 771; United Kingdom 399.
Oxides, hydroxides, pentoxides of metals	12	9	United Arab Emirates 3; France 1.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	35	3	Kenya 1.
Grinding and polishing wheels and stones	1,200	1,285	Ethiopia 359; Sudan 308; Iran 280; Saudi Arabia 122.
Asbestos	97	268	U.S.S.R. 108; Yugoslavia 104; West Germany 18.
Barite and witherite	129	690	United Kingdom 455; West Germany 200.
Boron materials, oxide and acid	22	25	All to Sweden.
Cement	112,217	338,651	Venezuela 127,316; Ireland 44,742; Iceland 24,040; Israel 22,843.
Chalk	16,988	17,367	Sweden 8,941; Norway 5,196; Finland 2,019; Tanzania 327.

See footnotes at end of table.

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Table 2.—Denmark: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Clays and clay products (including all refractory brick):			
Crude	19,612	2,217	Sweden 1,307; Norway 376; Finland 186; United Kingdom 140.
Products:			
Refractory[2]	35,597	32,119	United Kingdom 9,085; West Germany 5,005; Norway 2,657.
Nonrefractory	63,817	71,274	West Germany 53,790; Sweden 7,484; Norway 5,844.
Cryolite and chiolite	21,196	29,250	NA.
Diamond:			
Gem, not set or strung ____ value, thousands	$105	$346	Switzerland $246.
Industrial ____ troy ounces	322	32	Mainly to Switzerland.
Diatomite and other infusorial earth	62,857	53,115	West Germany 22,249; Netherlands 12,067; Switzerland 6,832.
Feldspar and fluorspar	41	21	NA.
Fertilizer materials:			
Crude:			
Phosphatic	--	732	Norway 395; Sweden 337.
Other	201	92	Sweden 60; Norway 32.
Manufactured:			
Nitrogenous	39,582	115	Faroe Islands 42; Iceland 31.
Phosphatic	7,189	25,695	Bangladesh 13,760; Nigeria 5,000; The Gambia 2,741; Ireland 2,271.
Potassic	89	111	Norway 79; West Germany 23.
Other, including mixed	29,584	24,617	China, mainland, 10,500; Iraq 5,996; United Kingdom 3,535; Indonesia 2,627.
Ammonia	1,401	486	West Germany 244; Sweden 167.
Graphite, natural	34	25	Mainly to Netherlands.
Gypsum and plasters	270	130	Sweden 88.
Lime	12,171	9,368	Norway 7,810; West Germany 851; Sweden 349; Norway 327.
Magnesite	34	89	Yugoslavia 65; France 23.
Mica, all forms	13	65	Finland 23; Switzerland 15; West Germany 10.
Pigments, mineral, including processed iron oxides	198	86	Sweden 19; Finland 17; United Kingdom 13; West Germany 10.
Precious and semiprecious stones, except diamond kilograms	30	82	NA.
Salt	61,531	67,094	Sweden 47,103; Norway 12,520; Finland 5,531.
Sodium and potassium compounds, n.e.s	312	1,610	Belgium-Luxembourg 1,202; Sweden 247; Faroe Islands 85.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	184,673	50,396	West Germany 49,715; Sweden 532.
Worked	4,370	5,577	West Germany 5,074; Norway 206; Sweden 119.
Dolomite, chiefly refractory grade	66	113	Iceland 63; Sweden 5.
Gravel and crushed rock ____ thousand tons	1,395	1,536	West Germany 1,503; Sweden 20.
Limestone (except dimension)	66,206	81,438	West Germany 45,573; Sweden 28,752; Norway 6,233.
Quartz and quartzite	121	217	Sweden 108; West Germany 33.
Sand, including metal bearing	144,255	138,325	Sweden 101,455; Norway 14,923; West Germany 10,245.
Sulfuric acid	510	39,137	Netherlands 17,255; Portugal 11,872; Switzerland 3,965.
Talc, steatite, soapstone, pyrophyllite	44	72	Oman 20; Iceland 15; People's Democratic Republic of Yemen 10.
Other:			
Crude	1,032	1,125	West Germany 609; Switzerland 206; Finland 181.
Slag, dross, and similar waste, not metal bearing	15,293	10,947	West Germany 3,615; Norway 3,444; Sweden 693; Netherlands 688.
Oxides and hydroxides of magnesium, strontium, barium	73	(1)	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	113	127	Portugal 20; Sweden 36; Yugoslavia 20; Finland 18.
Carbon black and gas carbon	28	20	Sweden 10; Kuwait 1; Saudi Arabia 1.
Coal and coke, including briquets	58,904	66,238	Norway 28,115; Sweden 25,344; West Germany 7,786.
Gas, hydrocarbon, liquefied	21,173	21,649	United Kingdom 8,275; Sweden 7,914; West Germany 1,500.
Peat, including peat briquets and litter	1,831	2,518	Sweden 1,167; Netherlands 533; West Germany 406.

See footnotes at end of table.

Table 2.—Denmark: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	5,155	5,037	Sweden 4,432; Norway 131; West Germany 121.
Kerosine and white spirit do	142	60	Sweden 33; Faroe Islands 17.
Distillate fuel oil do	8,713	8,513	Sweden 4,699; United Kingdom 2,130; Faroe Islands 718.
Residual fuel oil do	1,442	1,287	Sweden 748; Netherlands 297; Norway 131.
Lubricants do	189	193	Norway 125; Sweden 17.
Mineral jelly and wax do	5	5	Sweden 3.
Liquefied petroleum gas do	246	251	United Kingdom 96; Sweden 92; West Germany 17.
Pitch do	18	8	Sweden 6.
Bitumen and other residues do	831	834	Sweden 480; Norway 190; Finland 149.
Other[3] do	55	54	Norway 38; West Germany 11.
Total do	16,796	16,242	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	--	7,667	Norway 5,398; West Germany 1,515.

NA Not available.

[1] Less than 1/2 unit.

[2] Includes products of magnesite, diatomite, and other refractory materials.

[3] Including bituminous mixtures, n.e.s., and mineral tars and products.

Table 3.—Denmark: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate	4,543	10,134	All from Greece.
Oxide and hydroxide[1]	3,662	4,294	United Kingdom 2,366; Italy 986; West Germany 544; United States 271.
Metal including alloys:			
Scrap	2,776	1,637	Norway 749; West Germany 421; Sweden 273.
Unwrought	12,974	17,122	Norway 13,543; United Kingdom 1,858; Sweden 1,160.
Semimanufactures	53,955	51,151	West Germany 12,850; Norway 9,018; Sweden 8,715.
Antimony metal including alloys, all forms	20	8	Spain 5; Netherlands 2; China, mainland, 1.
Cadmium metal including alloys, all forms	8	8	All from Norway.
Chromium:			
Chromite	103	144	Finland 120; West Germany 24.
Oxide and hydroxide	510	147	West Germany 106; Italy 38.
Cobalt:			
Oxide and hydroxide	22	10	Belgium-Luxembourg 5; United Kingdom 3; Canada 2.
Metal including alloys, all forms	20	29	Belgium-Luxembourg 24; West Germany 3.
Copper metal including alloys:			
Scrap	795	1,460	France 735; West Germany 263; Finland 166; United Kingdom 132.
Unwrought	7,685	5,945	Belgium-Luxembourg 4,535; West Germany 618; Sweden 471.
Semimanufactures and master alloys	30,536	29,686	Sweden 8,901; Belgium-Luxembourg 7,697; West Germany 6,238.
Iron and steel:			
Ore and concentrate	512	2,715	All from Sweden.
Roasted pyrite	36,158	38,452	All from Norway.
Metal:			
Scrap	12,815	262,824	United Kingdom 159,749; West Germany 53,990; Sweden 27,431.
Pig iron, cast iron, other[2]	28,702	22,651	Norway 2,925; Sweden 2,664; German Democratic Republic 2,213; U.S.S.R. 1,889.
Ferroalloys	14,744	23,195	Norway 18,421; United Kingdom 2,348; Sweden 1,187; U.S.S.R. 88[illegible]
Steel, primary forms	73,031	36,201	Poland 15,125; Sweden 7,373; United Kingdom 4,490; West Germany 3,547.
Semimanufactures:			
Bars, rods, angles, shapes, sections[3]	367,628	377,764	West Germany 100,992; Sweden 63,580.

See footnotes at end of table.

Table 3.—Denmark: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Semimanufactures —Continued			
Universals, plates, sheets	609,664	602,180	West Germany 191,687; France 70,342; Belgium-Luxembourg 67,525; Sweden 55,123.
Hoop and strip	55,561	59,393	West Germany 29,633; Sweden 9,444; Netherlands 4,224.
Rails and accessories	11,985	11,970	France 7,481; West Germany 2,159; Belgium-Luxembourg 1,465.
Wire	24,233	27,605	West Germany 9,677; Belgium-Luxembourg 9,661; Sweden 4,563.
Tubes, pipes, fittings	173,846	203,627	West Germany 61,409; United Kingdom 29,265; Austria 23,022.
Castings and forgings, rough	1,270	2,158	West Germany 941; Norway 396; United Kingdom 243.
Total	1,244,187	1,284,697	
Lead:			
Oxide	887	786	West Germany 264; German Democratic Republic 220; France 140; United Kingdom 96.
Metal including alloys:			
Scrap	20,273	21,869	Netherlands 8,766; Norway 3,494; United Kingdom 3,283; West Germany 2,432.
Unwrought	8,107	7,280	Sweden 4,901; West Germany 799; United Kingdom 650.
Semimanufactures	1,857	2,009	West Germany 1,839; United Kingdom 94; Netherlands 29.
Magnesium metal including alloys, all forms	227	152	Norway 74; France 27; United Kingdom 17.
Manganese:			
Ore and concentrate	--	1,383	Netherlands 748; West Germany 226.
Oxide	2,880	2,153	Belgium-Luxembourg 1,071; Greece 665; United Kingdom 238.
Mercury 76-pound flasks	191	392	Spain 260; Italy 35; Sweden 35.
Molybdenum metal including alloys, all forms	6	3	West Germany 2.
Nickel:			
Matte	--	23	Canada 17; United Kingdom 6.
Metal including alloys:			
Unwrought and scrap	128	197	United Kingdom 97; United States 49; Finland 22; Canada 19.
Semimanufactures	227	240	West Germany 104; United Kingdom 32; Norway 23.
Platinum-group and silver metals including alloys, all forms:			
Platinum-group thousand troy ounces	20	34	Netherlands 20; Switzerland 6; West Germany 4.
Silver do	2,462	2,673	West Germany 865; United Kingdom 667; France 439.
Tin:			
Oxide	5	--	
Metal including alloys:			
Scrap	151	200	West Germany 98; Switzerland 65; Austria 17.
Unwrought	475	348	Italy 109; Malaysia 105; Thailand 45; United Kingdom 31.
Semimanufactures	114	84	West Germany 49; United Kingdom 13.
Titanium oxide	4,385	5,290	Norway 2,102; Netherlands 967; Finland 817; Italy 473.
Tungsten metal including alloys, all forms	13	14	West Germany 8; Sweden 3; United Kingdom 2.
Zinc:			
Oxide	2,456	2,320	West Germany 854; France 366; German Democratic Republic 320.
Metal including alloys:			
Scrap, including blue powder (dust)	1,281	2,043	Norway 1,581; West Germany 172; United Kingdom 132; Sweden 125.
Unwrought	15,934	13,614	Norway 4,483; Finland 3,958; United Kingdom 1,741; Netherlands 1,314.
Semimanufactures	4,110	4,000	France 2,929; West Germany 934; Belgium-Luxembourg 45; Norway 29.
Other:			
Ores and concentrates of base metals	205	59	Netherlands 54.
Ash and residue containing nonferrous metals	7,823	8,818	United States 2,722; Sweden 2,091; United Kingdom 1,340.
Metals including alloys, all forms:			
Metalloids	802	682	France 544; Norway 80; Sweden 51.
Alkali, alkaline-earth, rare-earth metals	232	242	West Germany 235; France 4.
Pyrophoric alloys	4	--	
Base metals including alloys, all forms, n.e.s.	--	35	Sweden 23; United Kingdom 2; United States 1.

See footnotes at end of table.

Table 3.—Denmark: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	10,064	12,501	Iceland 6,483; Portugal 5,220; Netherlands 444.
Dust and powder of precious and semiprecious stones kilograms	17	19	Switzerland 12; Netherlands 4.
Grinding and polishing wheels and stones	1,151	1,222	West Germany 469; Austria 294; Sweden 192.
Asbestos	26,926	21,470	Canada 12,456; Cyprus 4,187; Republic of South Africa 2,405.
Barite and witherite	4,471	5,863	Ireland 3,924; United Kingdom 947; West Germany 587; Netherlands 389.
Boron materials:			
Crude natural borates	63,857	51,770	West Germany 35,064; German Democratic Republic 9,279; Sweden 2,882.
Oxide and acid	234	263	France 170; Italy 69; West Germany 9.
Cement	29,518	19,382	West Germany 15,803; Norway 1,621; Sweden 726; France 673.
Chalk	6,951	8,942	West Germany 4,170; Sweden 2,497; France 1,345; Switzerland 900.
Clays and clay products (including all refractory brick):			
Crude: Kaolin and other	39,641	42,382	United Kingdom 26,619; West Germany 8,315; Czechoslovakia 2,982; France 947.
Products:			
Refractory (including nonclay brick)	34,566	33,282	West Germany 18,264; Austria 5,854; Sweden 4,957.
Nonrefractory	86,541	87,909	West Germany 33,209; Italy 32,067; Sweden 4,517.
Cryolite and chiolite	54,600	53,300	All from Greenland.
Diamond:			
Gem, not set or strung carats	9,632	5,437	Belgium-Luxembourg 2,015; Israel 888; Switzerland 676; United Kingdom 629.
Industrial kilograms	2	14	Switzerland 5; Republic of South Africa 4; United States 2.
Diatomite and other infusorial earth	4,607	4,233	United States 1,684; Iceland 1,010; Spain 626; France 558.
Feldspar, leucite, nepheline syenite	9,884	8,902	Norway 8,052; Sweden 638; West Germany 157.
Fertilizer materials:			
Crude:			
Nitrogenous	10,835	--	
Phosphatic	261,825	281,525	Morocco 183,066; United States 98,200; Sweden 160.
Potassic	925	825	All from West Germany.
Manufactured:			
Nitrogenous	161,397	108,709	Norway 64,071; West Germany 16,358; Netherlands 12,242; Switzerland 3,148.
Phosphatic:			
Thomas (basic) slag	124	51	All from West Germany.
Other	21,562	5,712	Israel 3,650; West Germany 1,346; Netherlands 666.
Potassic	225,280	219,646	West Germany 75,913; Canada 75,346; East Germany 42,075.
Other, including mixed	429,918	539,128	Norway 398,695; West Germany 84,219; Belgium-Luxembourg 29,674.
Ammonia	252,728	277,657	West Germany 88,806; United Kingdom 83,345; Kuwait 18,563; Venezuela 16,506.
Fluorspar	2,179	4,462	France 2,269; United Kingdom 1,208; West Germany 934.
Graphite, natural	740	754	West Germany 660; United Kingdom 44; Norway 27.
Gypsum and plasters	369,984	298,036	Spain 208,845; France 48,158; U.S.S.R. 28,682; Poland 5,696.
Lime	3,028	3,438	West Germany 2,335; Poland 862; Sweden 100.
Magnesite	9,638	19,046	Austria 8,969; Czechoslovakia 4,652; Spain 2,750; China, mainland, 1,894.
Mica:			
Crude, including splittings and waste	226	255	United Kingdom 119; Norway 80; Canada 35.
Worked, including agglomerated splittings	43	50	France 26; West Germany 12; Belgium-Luxembourg 8.
Pigments, mineral:			
Natural, crude	423	--	
Iron oxides, processed	4,249	5,360	West Germany 4,430; Spain 545; Netherlands 155; United Kingdom 119.

See footnotes at end of table.

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Table 3.—Denmark: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Precious and semiprecious stones, except diamond kilograms	1,044	5,678	Greenland 2,800; Republic of South Africa 1,152; West Germany 548.
Pyrite	3	31	All from West Germany.
Salt	377,876	2,791,065	West Germany 1,009,688; Italy 84,085; U.S.S.R. 39,564; Netherlands 7,051.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	3,309	4,509	Sweden 2,374; Norway 1,476; Italy 511.
Slate	10,376	9,594	Norway 3,547; West Germany 3,464; Sweden 2,119.
Other (granite, gneiss, etc.)	258,873	164,665	Sweden 114,361; Norway 50,137.
Worked, all types	55,683	55,307	Portugal 18,997; West Germany 14,477; Sweden 13,857.
Dolomite, chiefly refractory grade	28,422	30,472	Norway 21,428; West Germany 5,994; Sweden 3,022.
Gravel and crushed rock	773,242	870,583	Sweden 768,843; Norway 90,592; West Germany 8,596.
Limestone (except dimension)	227,449	205,691	Sweden 104,111; United Kingdom 57,880; Norway 37,404.
Quartz and quartzite	6,135	5,297	Sweden 3,940; Norway 975; West Germany 233.
Sand, excluding metal bearing	136,679	117,158	Belgium-Luxembourg 97,197; West Germany 9,048; Norway 5,907; Sweden 4,298.
Sulfur:			
Elemental, all forms	63,495	74,146	West Germany 63,108; Poland 6,550; Sweden 3,040.
Sulfur dioxide and sulfuric acid	5,587	11,720	West Germany 3,755; Norway 2,791; France 2,342; Netherlands 2,205.
Talc, steatite, soapstone, pyrophyllite	10,842	10,583	Norway 5,612; West Germany 1,585; Finland 1,376.
Other:			
Crude	63,858	51,770	West Germany 35,068; Sweden 2,882; France 1,418.
Slag, dross, and similar waste, not metal bearing	6,680	6,983	West Germany 4,825; United Kingdom 2,103.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,169	4,857	West Germany 2,605; Belgium-Luxembourg 1,310; United States 413.
Carbon black	3,683	3,765	West Germany 1,288; United Kingdom 918; Sweden 826.
Coal and coke, including briquets thousand tons	5,690	6,238	Poland 3,078; West Germany 972; Republic of South Africa 868; U.S.S.R. 528; Canada 307.
Gas, hydrocarbon, liquefied do	106	93	United Kingdom 32; West Germany 27; Sweden 18; Poland 11.
Peat, including peat briquets and litter	19,086	23,634	Sweden 16,393; Netherlands 2,600; U.S.S.R. 1,867; West Germany 1,784.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	53,904	56,650	United Kingdom 18,998; Iran 12,168; U.S.S.R. 11,547.
Refinery products:			
Gasoline do	11,499	8,551	Netherlands 2,451; United Kingdom 2,025; Sweden 1,654.
Kerosine and jet fuel do	6,114	6,671	Netherlands 2,282; France 1,175; United Kingdom 1,007.
Distillate fuel oil do	30,586	30,787	United Kingdom 10,295; Netherlands 5,075; U.S.S.R. 4,705.
Residual fuel oil do	33,027	28,098	Sweden 8,352; Netherlands 4,450; Kuwait 2,537.
Lubricants do	791	1,574	U.S.S.R. 721; United Kingdom 334; West Germany 251.
Mineral jelly and wax do	128	105	West Germany 54; Hungary 8; U.S.S.R. 8.
Petroleum coke, bitumen, other residues do	1,380	1,142	Netherlands 519; West Germany 424; Sweden 184.
Liquefied petroleum gas do	1,236	1,073	United Kingdom 362; West Germany 315; Sweden 212.
Other[4] do	201	129	Norway 54; West Germany 18; France 16.
Total do	84,962	78,130	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	--	18,442	Norway 7,682; West Germany 2,524; France 2,342.

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[1] Excluding synthetic corundum.
[2] Including spiegeleisen, grit, sponge iron, powder and shot.
[3] Including wire rod.
[4] Including mineral tar and products.

Table 4.—Faroe Islands: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum metal including alloys, semimanufactures	181	187	Denmark 78; Sweden 60; Norway 17; Switzerland 14.
Copper metal including alloys, semimanufactures	57	72	Denmark 60; West Germany 5; United Kingdom 5.
Iron and steel semimanufactures	1,533	1,477	Denmark 1,332; Norway 141.
Lead metal including alloys:			
Unwrought	22	26	All from Denmark.
Semimanufactures	13	13	Do.
Silver troy ounces	NA	9,677	Do.
Zinc metal including alloys:			
Scrap, including blue powder	--	20	Norway 16; Denmark 4.
Semimanufactures	20	8	All from Denmark.
NONMETALS			
Abrasives: Grinding wheels and stones	1	3	Denmark 1; Norway 1.
Cement	19,078	19,785	All from Denmark.
Clay products (including all refractory brick):			
Refractory (including nonclay brick)	25	129	Denmark 124; Sweden 4.
Nonrefractory	[1]321	392	Denmark 351; Sweden 18; West Germany 17.
Fertilizer materials, manufactured:			
Nitrogenous	--	103	Norway 61; Denmark 42.
Other, including mixed	746	578	All from Denmark.
Salt	27,545	20,106	Spain 19,571; West Germany 400; Denmark 116; United Kingdom 13.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked (granite, gneiss, etc.)	--	29	West Germany 17.
Worked, all types	68	21	All from Denmark.
Gravel and crushed rock	8,054	6,960	Norway 6,797; Denmark 152.
Sand, excluding metal bearing	39	143	All from Denmark.
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets	276	108	All from United Kingdom.
Gas, hydrocarbon, liquefied	60	60	All from Denmark.
Hydrogen, helium, rare gases	--	92	Do.
Peat, including peat briquets and litter	42	31	Denmark 24.
Petroleum refinery products:			
Gasoline 42-gallon barrels	108,672	123,190	All from Denmark.
Kerosine and jet fuel do	9,517	16,872	Do.
Distillate fuel oil do	726,403	499,141	Do.
Residual fuel oil do	120,679	280,226	Do.
Lubricants do	9,870	11,102	Do.
Bituminous mixtures do	18,125	17,919	Netherlands 15,211; United Kingdom 1,982; Denmark 679.

NA Not available.

[1] Excludes an unknown quantity valued at $84,622.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—A new ferrous scrap company, Danscrap A/S, was formed by the country's leading scrap interests, H. I. Hansen A/S of Odense, Petersen & Albeck A/S, and Levin Jern & Metal, both of Copenhagen. It was announced that Danscrap A/S will act as the sole agent for Det Danske Staalvalsevaerk (DDS), Denmark's only steelmaker, and will also be the sole agent for participating scrap companies.

The Danish Government approved state aid totaling about $50 million to DDS. One-third of the grant is a repayable capital loan; the rest is in the form of loan guarantees. The company also planned to increase its existing $50 million capital by 50% through contributions from its shareholders.

The production capacity of DDS was about 1.5 million tons of crude steel per year. The company is to become a virtually all-electric steelmaker, using scrap as the only raw material at its Frederiksvaerk plant, located north of Copenhagen. This was expected to occur in 1980, when the company's four open hearth furnaces and blooming mill are to be phased out in favor of two electric arc furnaces and a new billet casting plant.

Nonmetals.—*Cement.*—As Aalborg Portland-Cement-Fabrikk, owned by F. L. Smidth & Co., remained the country's sole cement manufacturer, with three plants in North Jutland: Rördal, near Aalborg, operated seven wet-process kilns (2.2 million tons per year); Lindholm, near Nörresundby, operated two kilns (285,000 tons per year); and Danmark, also near Aalborg, operated one kiln (185,000 tons per year).

Limestone.—Filler-extender and chalk whiting production ceased at Aalborg Portland-Cement-Fabrikk's Dania plant in North Jutland. Future deliveries were expected to come from the F. L. Smidth group's other holding, A/S Faxe Kalkbrud. Faxe Kalk produces about 25,000 tons per year chalk whiting at Stevns, south of Copenhagen on Zealand Island, and up to 200,000 tons per year of pulverized limestone at Fakse Ladeplads, located further to the south.

Mineral Fuels.—In 1978, there was no change in Denmark's virtually complete dependence on imported fuels. There was only a nominal production of crude oil and insignificant production of hydroelectric power. Discussion continued on the possibility of introducing nuclear power and utilising North Sea natural gas.

Table 5 shows supply and apparent consumption of fuel and power in 1977 and 1978.

Table 5.—Denmark and Greenland: Supply and apparent consumption of fuels and power for 1977 and 1978

(Million tons of standard coal equivalent[1])

	Total energy	Coal and coke	Petroleum and refinery products[2]	Hydroelectric power[3]
1977:				
Production[4]	0.8	--	0.8	--
Imports	35.1	5.7	29.1	0.3
Exports	3.4	--	3.2	.2
Apparent consumption	32.5	5.7	26.7	.1
1978:[p]				
Production[4]	.8	--	.8	--
Imports	33.7	6.3	26.9	.5
Exports	2.1	--	2.0	.1
Apparent consumption	32.4	6.3	25.7	.4

[p] Preliminary.

[1] 1 ton standard coal equivalent (SCE) = 7,000,000 kilocalories.

[2] Includes some liquid natural gas imports.

[3] Includes foreign trade of all electricity.

[4] Includes only primary energy.

Source: Danmarks Statistisk (København). Monthly Bulletin of Foreign Trade, December 1978.

Petroleum and Natural Gas.—The Danish Underground Consortium (DUC) and the Federal Republic of Germany's German Offshore Consortium, in a joint undertaking, were drilling the oil well Tove-1, some 25 kilometers south of the Dan Oilfield on the border between the Danish and West German North Sea sectors. DUC terminated its Per-1 well at 2,781 meters after insignificant oil shows and spudded Nils-1, which is about 11 kilometers southwest of the Dan Field.

Plans were readied for utilizing the recoverable natural gas reserves in the Danish sector of the North Sea, estimated at 110 to 120 billion cubic meters.[4] According to plans, the natural gas would be used in Denmark to supply about 15% to 20% of the country's consumption for 20 to 30 years. This plan would make necessary the construction of a distribution network of some 15,000 kilometers in length. Connections of this network to both West Germany and Sweden would enable Sweden to import an additional 1.2 billion cubic meters of natural gas annually from West Germany.

Production was virtually unchanged at Dan, Denmark's only operating oilfield, located about 200 kilometers west of Ejsberg in 41 meters of water. About 27 kilometers northwest of Dan, the Gorm Oilfield was under development. Recoverable reserves at Gorm were estimated at 15 to 22 million tons of crude oil.[5] Production was expected to start in 1981.

Denmark's oil refining capacity remained unchanged at about 11.75 million tons per year, divided mainly among Gulf Refining Co., Dansk Esso A/S, and A/S Dansk Shell, with refineries located respectively at Stignaes, Kalundborg (both on Zealand Island), and Fredericia (in Jutland).

GREENLAND

In January 1979, Greenland obtained home rule, which gave the local Government veto power over all mineral exploration, but Greenland remained heavily dependent on Danish financial aid. Greenland continued to be a producer of lead and zinc concentrates and talc, and shipped some crude cryolite from existing stocks.

Greenland's mineral production in 1976, 1977, 1978 and 1979 is shown in table 6. Greenland's total foreign trade for 1977 and 1978 is shown in tables 7 and 8.

Table 6.—Greenland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
Lead, mine output, metal content	27,000	28,800	30,600	31,000
Silver, mine output, metal content (thousand troy ounces)	479	521	559	[2]617
Zinc, mine output, metal content	81,000	76,600	82,400	87,300

[e] Estimate. [p] Preliminary.

[1] In addition to the commodities listed, a variety of crude construction materials (common clays, sand and gravel, and stone) are undoubtedly produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

Table 7.—Greenland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
Copper metal including alloys, scrap	--	82	All to Denmark.
Cryolite and chiolite	54,600	53,302	Do.
Lead ore and concentrate	41,660	43,205	France 24,302; West Germany 10,817; Italy 2,869; Brazil 2,847; Greece 2,370.
Precious and semiprecious stones, except diamond kilograms	--	2,800	All to Denmark.
Stone, dimension, worked	4	2	Do.
Zinc ore and concentrate	135,772	138,737	Finland 80,807; France 30,954; West Germany 17,021; Italy 9,955.

Table 8.—Greenland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978.
METALS			
Aluminum metal including alloys, all forms	37	43	All from Denmark.
Copper metal including alloys, semimanufactures	34	46	Do.
Iron and steel semimanufactures: Bars, rods, angles, shapes, sections	1,643	2,085	Denmark 1,909; Belgium-Luxembourg 176.
Lead metal including alloys, unwrought	2	20	All from Denmark.
Tin metal including alloys, semimanufactures	--	5	Do.
Zinc metal including alloys, semimanufactures	17	10	Do.
NONMETALS			
Boron materials: Crude natural borates	--	45	Do.
Cement	6,727	6,678	Do.
Clay products (including all refractory brick):			
Refractory (including nonclay brick)	5	32	Do.
Nonrefractory	([1])	314	Denmark 282; West Germany 32.
Diatomite and other infusorial earth	2	--	
Fertilizer materials:			
Manufactured, including mixed	69	71	All from Denmark.
Ammonia	9	7	Do.
Salt	1,976	5,015	Spain 4,346; Denmark 559; United Kingdom 60; Tunisia 50.
Stone, sand and gravel:			
Gravel and crushed rock	--	1,620	All from Denmark.
Sand, excluding metal bearing	16	65	Do.
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets	7	2,652	Do.
Gas, hydrocarbon, liquefied	71	131	Do.
Petroleum refinery products:			
Gasoline 42-gallon barrels	90,006	34,850	United Kingdom 17,051; Belgium-Luxembourg 15,912; Denmark 1,887.
Kerosine and jet fuel do.	275	56,998	United Kingdom 27,272; Belgium-Luxembourg 20,872; Denmark 8,854.
Distillate fuel oil do.	1,534,067	106,671	All from Denmark.
Residual fuel oil do.	--	657,648	United Kingdom 317,103; Netherlands 189,310; Sweden 94,565; Belgium-Luxembourg 56,670.
Lubricants do.	9,429	9,065	All from Denmark.
Bituminous mixtures do.	677	3,912	Do.

[1] Value only reported at $125,433.

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COMMODITY REVIEW

Petroleum.—Of 13 offshore concessions awarded in 1975, in an area about 250 miles west of Holsteinsborg, 10 were abandoned in 1977. Mobil Oil A/S and Chevron Oil A/S, together with the National Iranian Oil Co. as a partner, were still planning to drill. In the meantime, attention was turning to the east coast of Greenland, where the Danish Government was planning to spend $2 million on exploration.

Uranium.—Uranium reserves of about 27,000 tons were discovered at Kvanefjeld near Narassaq by the Danish State Atomic Research Institute. The ore assayed 340 grams of uranium per ton, and another 16,000 tons of uranium ore at the same location assayed 300 grams per ton of uranium.[6]

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted to U.S. dollars from Danish kroner (DKr) at the rate of DK6.25=US$1.00.

[3] U.S. Embassy, Copenhagen. State Department Airgram A-36, Aug. 10, 1979, p. 2.

[4] Petroleum Economist. V. 46, No. 1, January 1979, p. 28.

[5] Erdöl and Kohle, V. 31, No. 10, October 1978, p. 496.

[6] Grönlandeposten. Oct. 26, 1978, p. 4.

The Mineral Industry of Egypt

By Candice Stevens[1]

Increased petroleum production boosted Egypt's gross national product (GNP) to $13 billion[2] in 1978 and to an estimated $15 billion in 1979. The principal mineral industries outside the oil sector were iron and steel, aluminum, phosphate, and small nonmetallic mineral operations. Egypt's economy continued to suffer from a large balance-of-trade deficit, growing external debts, and high unemployment and inflation rates. A new economic program (1978-1982) was issued during 1978 which aimed to produce a growth rate of at least 8% per year, reduce inflation to less than 10% per year, and promote equilibrium in the balance-of-payments. The peace agreement concluded with Israel in 1979 provided for the return of portions of the Sinai Peninsula and its petroleum and mineral resources. In 1978, the International Monetary Fund agreed to lend Egypt $750 million over a 3-year period contingent on the enactment of certain economic reforms. The United States continued to be the largest single aid donor to Egypt with annual assistance of $1 billion since 1975.

Egypt hoped to increase its foreign exchange earnings through revenues from petroleum production, tourism, the Suez Canal, the Suez-Mediterranean pipeline (SUMED), and increased remittances from Egyptian workers abroad. Plans were being enacted to expand production in all major mineral industries and to increase surveying and exploration efforts. The Egyptian Geological Survey Organization was conducting a detailed mineral survey of the Eastern Desert, which focused on deposits of copper-nickel, copper-zinc, gold, and tantalum. A regional Geological Survey office was to be established at Al Arish in the Sinai Peninsula to investigate the development of Sinai mineral deposits including manganese, coal, kaolin, gypsum, and glass sands. In 1978, Continental Oil Company (Conoco) completed metalogenic maps of the Western Desert and began work in conjunction with the U.S. Geological Survey on a new geologic map of Egypt in 1979.

Further infrastructure development was also scheduled under Egypt's economic program. The first phase of the deepening and widening of the Suez Canal was to be completed by 1980. The expansion program was to enable ships up to 150,000 tons, laden, to transit the Canal; the second stage of construction work would enable passage of ships up to 260,000 tons, laden. In 1978 and 1979, the Suez Canal earned about $500 million annually in transit fees, which were expected to increase to $1 billion per year by 1985.

The construction of the Sidi Kreir nuclear power station west of Alexandria remained a subject of negotiation. This was one of two 600-megawatt nuclear reactors to be supplied by Westinghouse Electric Corporation (United States) under an agreement concluded in 1976. In 1979, the Egyptian Electricity Authority received a $102 million loan from the International Bank for Reconstruction and Development (IBRD) toward the financing of a 900-megawatt thermal power station at Shoubrah El Kheima north of Cairo. Technical studies on the construction of a 10,000-megawatt hydroelectric powerplant in the Qattara depression were completed in 1979. No decision was made on the $1 billion project by yearend. In 1978 and 1979, oil and natural gas accounted for about 70% of Egypt's energy requirements. Hydroelectric power based on the 2,100-megawatt Aswan Dam powerplant accounted for the remainder.

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PRODUCTION AND TRADE

Production of most of Egypt's major mineral commodities increased in 1978 and 1979 as Egypt intensified its mineral development efforts. Petroleum production increased from 151 million barrels in 1977 to 176 million barrels in 1978 and to about 188 million barrels in 1979 as new oilfields were brought onstream. Ongoing exploration was expected to raise production to 1 million barrels per day of oil by 1982. Iron ore production has risen steadily owing to increased exploitation of the Bahariya Oasis deposits. Phosphate production increased to 639,000 tons in 1978 and was to more than double in the next 6 years with the development of new deposits. In line with the development of raw material supplies, steel, fertilizer, and cement facilities were undergoing expansions in capacities. Mineral production in Egypt is shown in table 1.

Egypt had a balance-of-trade deficit of $3.3 billion in 1978 and approximately $4.3 billion in 1979. Principal mineral exports were petroleum and petroleum products, phosphate rock, aluminum, iron and steel, and salt. Egypt had a $720 million surplus on its oil account in 1978 and an $850 million surplus in 1979. Petroleum was exported primarily to Italy (56%) and other Western European countries. However, increased crude oil exports were unable to offset needed imports of petroleum products, basic foodstuffs, and intermediate capital goods for industry. The United States was one of Egypt's largest trading partners and supplied $1.1 billion in exports to Egypt in 1978 and $1.5 billion in exports in 1979.

Table 1.—Egypt: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum metal	59,000	89,182	100,698	100,000
Chromite	243	500	873	500
Iron and steel:				
Iron ore and concentrate thousand tons	1,243	1,409	1,456	1,500
Pig iron do	250	250	[e]300	300
Ferroalloys (ferrosilicon) do	5	5	[e]5	5
Crude steel do	457	263	[e]600	635
Semimanufactures do	706	621	1,000	1,000
Manganese ore and concentrate	4,256	3,833	173	--
NONMETALS				
Asbestos	1,096	478	349	350
Barite	288	746	989	900
Cement, hydraulic thousand tons	3,362	3,257	3,000	3,250
Clays:				
Bentonite	4,233	3,811	3,448	3,500
Fire clay	170,052	143,648	383,389	250,000
Kaolin	28,267	49,000	55,577	50,000
Diatomite	327	373	99	90
Feldspar, crude	2,128	2,633	3,337	3,350
Fluorspar	[r]1,557	1,404	2,235	2,450
Gypsum and anhydrite, crude	466,604	508,635	798,000	800,000
Mica	[e]10	86	[e]86	--
Nitrogen: N content of ammonia thousand tons	[e]210	210	250	345
Phosphate:				
Phosphate rock do	394	472	639	660
Thomas slag do	523	NA	NA	NA
Pigments, mineral, natural: Iron oxide	3,257	32	245	100
Pumice	[e]250	[e]250	[e]300	300
Salt, marine thousand tons	480	597	755	760
Sodium compounds:				
Sodium carbonate	NA	NA	4,000	5,000
Sodium sulfate	4,000	5,000	2,902	3,000
Stone, sand and gravel:				
Basalt thousand cubic meters	243	213	281	[1]650
Dolomite thousand tons	120	92	130	[1]104
Granite, dimension cubic meters	NA	NA	NA	[1]2,000
Gravel thousand cubic meters	1,500	1,900	2,000	3,300

See footnotes at end of table.

Table 1.—Egypt: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978ᵖ	1979ᵉ
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Limestone and other calcareous ... thousand cubic meters	5,400	5,500	5,667	¹5,845
Marble blocks (including alabaster) ... cubic meters	NA	11,000	25,718	¹26,000
Quartz	8,103	9,332	11,348	10,000
Sand, including glass sand ... thousand cubic meters	3,535	2,973	2,996	3,000
Sandstone ... do	120	120	111	100
Sulfur:				
Elemental, byproduct	5,000	ᵉ5,000	3,106	5,000
Sulfuric acid	31,000	NA	NA	NA
Talc, soapstone, steatite, pyrophyllite	5,636	6,993	5,905	6,000
MINERAL FUELS AND RELATED MATERIALS				
Coke:				
Oven and beehive ... thousand tons	ᵉ650	694	700	¹853
Gashouse and other low temperature ... do	29	ᵉ30	ᵉ40	50
Total ... do	679	724	740	903
Gas, natural:				
Gross productionᵉ ... million cubic feet	ʳ65,000	93,000	105,800	140,000
Marketed ... do	13,432	18,670	30,835	120,000
Petroleum:				
Crude ... thousand 42-gallon barrels	120,180	150,925	175,925	190,000
Refinery products:				
Gasoline and naphtha ... do	12,521	6,936	8,109	9,000
Kerosine and jet fuel ... do	11,196	11,671	12,849	14,000
Distillate fuel oil ... do	12,809	14,629	16,412	18,000
Residual fuel oil ... do	33,673	32,265	36,210	38,000
Lubricants ... do	--	336	434	500
Other:				
Liquefied petroleum gas ... do	--	846	}	
Asphalt ... do	818	--	} 6,115	6,500
Unspecified ... do	--	6,542	}	
Refinery fuel and losses ... do	4,279	3,976	2,631	3,000
Total ... do	75,296	77,201	82,760	89,000

ᵉEstimate. ᵖPreliminary. ʳRevised. NA Not available.
¹Reported figure.

Table 2.—Egypt: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum metal:		
Unwrought	2,122	--
Semimanufactures	21,902	32,713
Copper metal, unwrought	100	--
Iron and steel metal:		
Pig iron, cast iron, spiegeleisen	38,584	14,671
Ferroalloys	1,000	--
Semimanufactures:		
Bars, rods, angles, shapes, sections	177	96
Plates and sheets	19,687	7,050
Pipes and tubes	1,700	407
NONMETALS		
Cement	24,609	18,010
Fertilizer materials:		
Crude, phosphatic	119,363	59,166
Manufactured, phosphatic	31,250	23,350
Graphite	150	--
Gypsum	9,523	25,019
Lime	ʳ5,138	1,533
Salt, common	7,006	72,102
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	538	852
Petroleum:		
Crude ... thousand 42-gallon barrels	ʳ28,398	28,892

See footnotes at end of table.

Table 2.—Egypt: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
MINERAL FUELS AND RELATED MATERIALS —Continued		
Petroleum —Continued		
Refinery products:		
Kerosine thousand 42-gallon barrels	--	322
Distillate fuel oil do	3,279	2,585
Asphalt and bitumen do	31	(1)

ʳRevised.
[1] Less than 1/2 unit.

Source: Central Agency for Public Mobilization and Statistics. Monthly Bulletin of Foreign Trade. April 1978, 677 pp.

Table 3.—Egypt: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum:		
Alumina	53	--
Metal:		
Unwrought[1]	1,533	772
Semimanufactures	1,840	1,315
Copper metal:		
Scrap	NA	775
Unwrought[2]	559	2,002
Semimanufactures	2,276	2,289
Gold metal, unworked troy ounces	145	--
Iron and steel:		
Roasted iron pyrites	20,530	10,445
Metal:		
Scrap	69,454	115,482
Pig iron, including cast iron	36,571	32,649
Ferroalloys	1,078	7,585
Steel:		
Common:		
Steel, primary forms	ʳ8,878	2,488
Semimanufactures:		
Bars, rods, angles, shapes, sections	ʳ300,363	214,986
Universals, plates, sheets	56,670	60,290
Hoop and strip	16,977	14,585
Rails and accessories	29,151	60,328
Wire	16,615	20,709
Tubes, pipes, and fittings	ʳ32,365	27,065
High carbon and alloy: Ingots and semimanufactures, all forms	8,160	7,510
Lead:		
Oxide	1,466	1,259
Metal:		
Scrap	1,006	1,209
Unwrought	ʳ6,545	10,096
Manganese oxide	1,906	2,854
Mercury 76-pound flasks	377	--
Silver metal troy ounces	52,607	--
Tin:		
Oxide	NA	54
Metal:		
Unwrought	854	215
Semimanufactures	128	--
Titanium oxide	1,127	1,049
Tungsten metal, unwrought	4	--
Zinc:		
Oxide	340	559
Metal:		
Unwrought	1,464	1,222
Semimanufactures	603	324
Other ores and concentrates	1,866	2,711
NONMETALS		
Abrasives:		
Crude: Natural corundum	143	295
Grinding and polishing wheels and stones	269	1,023
Asbestos	13,322	15,389
Cement	602,574	1,224,967
Clays and clay products:		
Crude	22,314	18,946
Products, refractory	ʳ16,871	20,145
Cryolite and chiolite	4,229	5,384
Diatomite and other infusorial earth	431	1,012

See footnotes at end of table.

Table 3.—Egypt: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
NONMETALS —Continued		
Feldspar and fluorspar	192	4,032
Fertilizer materials, crude and manufactured	433,297	491,782
Graphite	1,456	--
Pigments, mineral: Processed iron oxides	1,307	--
Pyrites, unroasted	28,179	66,521
Salt, common	320	59,553
Sodium and potassium compounds:[3]		
Caustic soda	58,927	14,414
Caustic potash	454	381
Stone:		
Dolomite	NA	1,700
Marble	4,740	4,036
Sulfur	75,954	110,966
Talc	298	407
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	3,156	3,119
Coal	978,513	1,042,455
Coke	51,763	51,896
Peat	2,006	3,253
Petroleum:		
Crude ... thousand 42-gallon barrels	4,702	--
Refinery products:		
Gasoline ... do.	25	10
Kerosine ... do.	415	24
Distillate and residual fuel oil ... do.	737	169
Lubricants ... do.	380	511
Other:		
Liquefied petroleum gas ... do.	1,843	2,245
Paraffin wax ... do.	r30	23
Unspecified ... do.	r12	23

rRevised. NA Not available.

[1] May include waste and scrap.

[2] May include copper matte, waste, and scrap.

[3] Excludes 21,691 tons and 893 tons for France and the Netherlands, respectively, listed as "Caustic soda and potash and peroxides of sodium or potassium" in source.

Source: Central Agency for Public Mobilization and Statistics. Monthly Bulletin of Foreign Trade. April 1978, 677 pp.

COMMODITY REVIEW

METALS

Aluminum.—Production capacity of the Naj Hammâdi aluminum complex was scheduled to increase from 100,000 tons per year in 1978 to 160,000 tons per year in 1980. Alumina was imported from Australia through the Red Sea port of Safâga and transported 200 kilometers to Naj Hammâdi. Approximately 25% of the output of the plant, operated by the state-owned Aluminum Company of Egypt, was consumed domestically. The remainder of production was exported to Western European countries and Japan.

Egypt proceeded with its plans to build a full range of aluminum extruding, fabricating, and finishing facilities. In 1977, an aluminum extrusion plant came onstream at Ismailia using aluminum pellets from Naj Hammâdi. In 1978, an agreement was signed with Krupp A.G. (Federal Republic of Germany) for a joint venture in aluminum and zinc smelting. The plant was to produce 24,000 tons per year of rolled aluminum and zinc plates and strips.

Copper.—The Egyptian Geological Survey Organization continued its investigation of copper deposits in the Eastern Desert. Surveys indicated that deposits at Um Samiuki contained reserves of 150,000 tons of ore assaying 15.2% zinc, 1.15% copper, 1.10% lead, and 50 grams per ton of silver. Copper-nickel deposits at Gebel Homr and El Ghariba were estimated to contain 70,000 tons of 0.95% copper ore.

Iron and Steel.—The production of iron ore increased steadily from 1.4 million tons in 1977 to 1.45 million tons in 1978 and to approximately 1.5 million tons in 1979 as development work continued at the Bahariya Oasis deposits. Egypt also mined approximately 70,000 tons per year of 44% iron ore from smaller deposits at Aswan. The Bahariya deposits, located 300 kilometers southwest of Helwân, were eventually to yield 3.5 million tons per year of iron ore. Reserves at the major mine, El Gedida, were estimated at 120 million tons of 54% iron ore. Total reserves at Bahriya were estimated at 250 million tons. More than $500 million was invested in the development of the open pit mine and associated infrastructure.

With the full utilization of Bahariya ore and further operating improvements, the Helwân iron and steel complex was expected to reach a targeted output of 1.5 million tons per year of steel by 1980. Gas supplies from the Abu Gharadiq Field were to fuel the complex and replace coking coal previously imported from Poland and the U.S.S.R. Facilities at Helwân included an 80,000 ton-per-year heavy section mill, an 80,000-ton-per-year merchant bar mill, a 110,000-ton-per-year hot strip mill, and a 300,000-ton-per-year cold reduction mill. More than 90% of Helwân's production was sold domestically and Egypt remained a net importer of steel. Approximately 70,000 tons of steel products were exported to other Middle Eastern Countries in 1978.

Egypt's three other steelmaking facilities produced reinforcing rods for domestic use. These were the 100,000-ton-per-year Copper Works in Alexandria, the 80,000-ton-per-year Delta Steel Co. in Cairo, and the 250,000-ton-per-year Abu Zaabal Works in Abu Zaabal.

Construction was not yet begun on the proposed direct reduction steel plant at Dekhela. The $380 million plant was to be a joint venture including the Egyptian General Organization for Industrialization (50%), the Japanese firm C. Itoh and Co. Ltd. (25%), the West German firm Korf-Stahl A.G. (15%), and the Brazilian firm Companhia Vale de Rio Doce (10%). Using iron ore pellets imported from Brazil and natural gas from the Abû Qîr Field, the plant was to produce 1.6 million tons per year of steel.

Manganese.—Manganese was produced at the Wadi Meialik deposits located in the Eastern Desert near the Sudanese border. Production at this location was becoming increasingly uneconomic owing to high transportation costs. Feasibility studies were to be conducted on the exploitation of the Umma Bogma deposits on the Sinai Peninsula, which had been mined until 1967. Reserves at Umma Bogma were estimated at 2 million tons of 21% manganese ore. The state-owned Sinai Manganese Co. was also to investigate the re-establishment of an associated ferromanganese facility at Abu Zenima. The plant, which had been near completion in 1967, had a production capacity of 10,000 tons per year of ferromanganese alloys. The overall project would include the provision of mining equipment, ore transport and shiploading facilities, the construction of a complex for the reduction and refining of ferruginous manganese ores, the rehabilitation of the company's township, and the provision of managerial and technical services.

Uranium.—The Nuclear Materials Corporation reported the existence of significant deposits of uranium in the Sinai and the Eastern Desert. The Nuclear Materials Corporation, a division of the Ministry of Electricity and Energy, was responsible for the exploration, mining, and processing of uranium, thorium, and other nuclear materials. Airborne surveys in 1978 identified a total of 7,000 radioactive anomolies in the country. Areas of El Missikat, El Atsham, and Qatrani were to undergo further investigation.

Extensive sampling and drilling were also carried out on the black sands along the Mediterranean coast and Nile Delta. A pilot plant was constructed for separating and processing the uraniferous sands. Monazite from the sands was shown to contain 5.2% thorium and 0.38% uranium. Reserves in the top layer (about 1 meter) were estimated at 14,700 tons of thorium and 1,070 tons of uranium. Additional resources were estimated at 280,000 tons of thorium and 20,000 tons of uranium. Phosphate deposits at Abu Tartûr were also estimated to contain 100,000 tons of uranium.

NONMETALS

Cement.—Egypt planned to double cement production capacity by 1983 through the expansion of existing facilities and the construction of new plants. Total installed capacity was rated at 4 million tons per year but owing to the age of the equipment at the older plants, production has declined to less than 3.3 million tons per year. Annual imports of cement were over 2 million tons. Cement plant capacity increases were planned as follows:

Location	Company	Start-up date	Current Capacity (thousand tons per year)	Planned Capacity (thousand tons per year)
Alexandria	Alexandria Portland Cement Co.	1948	500	1,000
Assiut	National Cement Co	1960	700	1,000
Helwân	Helwân Portland Cement Co.	1930	1,400	1,400
Torah	Torah Portland Cement Co	1929	1,400	2,400
Suez	Suez Cement Co	1981	--	1,000
Naj Hammâdi	National Cement Co	1983	--	1,000

Clays.—Kaolin production almost doubled in 1978 from previous levels owing to expansion in capacity at the Kalabsha deposits. Reserves at Kalabsha, located 105 kilometers southwest of Aswan, were estimated at 16 million tons of kaolin with a 38% alumina content. The Geological Survey Organization was examining the Kalabsha deposits, and also deposits of nepheline syenite in the Abou Khroug area of the Eastern Desert, for possible use in the production of aluminum. Egypt's remaining kaolin deposits were located near Umma Bogma in the Sinai Peninsula. The open-pit kaolin mines had been mined at the rate of 30,000 tons per year in 1966 and 1967, and studies were initiated on resuming the mining operation.

Fertilizer Materials.—Egypt's production capacity for nitrogenous fertilizer was estimated at 1.7 million tons per year. Capacity for the production of phosphatic fertilizer was 650,000 tons per year. Construction continued on Egypt's new fertilizer plants which were expected to make the country self-sufficient in fertilizer production by 1980. Egypts operating and projected fertilizer plants were as follows:

Location	Operator	Primary Product	Start-up Date	Capacity (thousand tons per year)
Suez	Société el Nasr d' Engrais et d' Industries Chimiques.	Calcium nitrate.	1951	275
Aswan	Egyptian Chemical Industries Co. (KIMA)	do	1960	400
Helwân	El Nasr Co. for Manufacturing Coke and Chemicals.	do	1964	140
Talkhâ (I)	Société el Nasr d' Engrais et d' Industries Chimiques.	do	1975	365
Talkhâ (II)	do	Urea	1980	570
Abû Qir	do	Urea	1979	500
Kafr-el-Zaiyat	Société Financiere et Industrielle d' Egypte S.A.	Single superphosphate.	1937	200
Abu Zaabal	Abu Zaabal Fertilizer and Chemical Co.	do	1948	200
Assiut	Société Financiere et Industrielle d' Egypte S.A.	do	1969	200
Kosseir	Kosseir Phosphate Co.	do	1958	50
Abu Zaabal	Abu Zaabal Fertilizer and Chemical Co.	Triple Superphosphate.	1980	175

Egypt's older nitrogenous fertilizer plants were designed to operate on locally available byproduct gases, namely coke oven gas and refinery gas. The Abû Qir plant, which came onstream in September 1979, used natural gas supplies from the Abû Qir Field. The Talkha II plant, which was to use natural gas from the Abu Madi Field, was to be the country's largest fertilizer facility. Daily production was to consist of 1,200 tons of ammonia, 1,700 tons of urea, and 180 tons of ammonium nitrate.

Egypt's phosphatic fertilizer plants all produced single superphosphate from rock phosphate and sulfuric acid. The plant under construction at Abu Zaabal was to produce 175,000 tons of triple superphosphate and 200,000 tons of phosphoric acid per year. Lurgi (Federal Republic of Germany) and Babcock-Moxley (United Kingdom) were contracted for construction of the plant which was to use phosphate rock from the West Sabaya mine.

Phosphates.—Egypt's phosphate production was expected to undergo a multifold increase as current operations were expanded and new deposits were exploited by 1985. Egypt's major phosphate companies were as follows:

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Location	Company	Current Capacity (thousand tons per year)	Planned Capacity (thousand tons per year)
Safaga, Kosseir	Red Sea Phosphate Co	150	0 (1980)
Hamrawein	Nasr Phosphate Co	600	1,200 (1980)
West Sabaya	El Nasr Phosphate Co	120	500 (1981)
Mahamid	El Nasr Phosphate Co	100	450 (1981)
Abu Tartur	Abu Tartur Phosphate Co	0	7,000 (1985)

In the Red Sea area of the Eastern Desert, the older Safaga and Kosseir mines were expected to be depleted by 1980. However, the nearby Hamrawein deposits, where reserves were estimated at 400 million tons, were to produce 1.2 million tons per year by 1980. In the Nile Valley, Seltrust Engineering (United Kingdom) was awarded a contract in 1978 to undertake technical and economic studies for the expansion of phosphate mining at West Sabaya and Mahamid. The studies were to include an assessment of ore reserves, the development of new mining methods, basic engineering for a new beneficiation plant, and evaluation of necessary infrastructure. Part of the production from the two mines would be used as feedstock for the Abu Zaabal fertilizer plant.

Egypt's most substantial phosphate deposits were located at Abu Tartûr in the Western Desert. Reserves were estimated at 1 billion tons with an average P_2O_5 content of 25.6%. In 1978, IBRD approved funding of $11 million for a complete feasibility study of the Abu Tartûr project. Engineering studies were being conducted by Sofremines of France and Alusuisse of Switzerland. In 1979, it was decided to reduce the scale of the project from the original production capacity of 10 million tons per year of ore owing to infrastructure and beneficiation problems.

Sulfur.—In 1979, Klockner A.G. (Federal Republic of Germany) was awarded a contract by Chama Sulfur Company for the construction of four sulfur grinding units near Alexandria. Scheduled to begin production in 1980, the plant was to grind 20,000 tons per year of sulfur rock into sulfur powder. At the same time, feasibility studies were being conducted on sulfur deposits in the Siwa Oasis area of northwest Egypt and at Ras Gemsa, 300 kilometers south of Suez. The Ras Gemsa deposit was mined from 1958 to 1963 with peak output reported at 7,000 tons per year.

Trona.—Egypt, one of the few sources of natural sodium carbonate, produced about 4,000 tons per year of trona in recent years. The major deposits were at Wadi Natrum, located northwest of Cairo. Sodium carbonate was used in the Misr Chemical Manufacturing Co. plant near Alexandria. The plant used imported and domestic sodium carbonate in the production of 45,000 tons of caustic soda, 5,000 tons of sodium bicarbonate, and 32,000 tons of heavy sodium carbonate per year.

MINERAL FUELS

Coal.—A feasibility study on reopening the Maghara coal deposits in the Sinai Peninsula was to be conducted. Egypt has imported all coal needs since the Maghara mines were closed in 1967. Located 90 kilometers southwest of El Arish, the Maghara deposits were estimated to contain reserves of 50 million tons of coal.

Natural Gas.—Egypt marketed approximately 100 billion cubic feet per year of gas with most of production directed towards power generation and industry. Natural gas reserves of the three major nonassociated gasfields, Abu Madi, Abû Qir, and Abu Gharadiq, were estimated at 5 trillion cubic feet. The Egyptian General Petroleum Authority (EGPA) estimated that associated natural gas production from Suez Gulf oil operations totaled 280 million cubic feet per day, most of which was flared. In 1979, Egypt received a loan of $79 million from the IBRD to finance a project to gather, process, and transport the associated gas. The $170 million venture was to include gas-gathering stations, a natural gas liquids facility, compression units, pipelines, and related services.

Drilling began on new wells at the Abu Madi Field, located in the Nile Delta north of Port Said. Operated by EGPA, the Abu Madi Field produced 150 million cubic feet per day of gas for use in local industry and the new Talkhá fertilizer complex. The Abu Gharadiq Field was operated by the Faiyum Petroleum Company (FAPCO), a joint venture of EGPA and Amoco Egypt Oil Co.

Production at the rate of 90 million cubic feet per day was used to fuel steel and cement plants.

Initial production began at the Abú Qír Field operated by the Western Desert Petroleum Co. (WEPCO), a joint venture of EGPA and Phillips Petroleum Company. Output was to eventually reach 150 million cubic feet per day for use in nearby fertilizer and power plants. In 1978, EGPA also issued tenders for the execution of a natural gas distribution system in the Cairo residential districts.

Petroleum.—*Production.*—The Egyptian oil industry grew considerably in the last two decades despite the occupation by Israel from 1967 to 1975 of oilfields formerly operated in the Sinai Peninsula. In November 1979, Israel returned the offshore Alma field in the southeastern area of the Gulf of Suez. The Alma Field was expected to add 30,000 barrels per day to Egyptian production and contribute to the targeted output of 1 million barrels per day by 1982. Egyptian petroleum reserves were estimated at 2.45 billion barrels. EGPA supervised all exploration, production, refining, and marketing of crude and refined petroleum. Egypt was not a member of the Organization of Petroleum Exporting Countries (OPEC) and gradually increased the price of its Gulf of Suez blend export crude from $13.46 per barrel in January 1979 to $34.00 per barrel in December 1979.

The major area of oil production was the Gulf of Suez where oil was discovered in 33 structures, of which 20 were producing in 1978 and 1979. The Gulf of Suez Petroleum Company (GUPCO), a joint venture of EGPA and Amoco, produced about 75% of Egypt's oil output. GUPCO's production was from three major fields—El Morgan, July, and Ramadan—and was scheduled to increase as the three new fields brought onstream in 1977 were further developed.

Production from oilfields in the Sinai Peninsula accounted for about 17% of total output. Cie. Orientale des Petroles d'Egypte (COPE), a joint venture of EGPA and the Italian firm Ente Nazionale Idrocarburi (ENI), boosted production from the main Sinai field, Abu Rudeis, to an average of 50,000 barrels per day. In 1978, EGPA and ENI formed a new joint company, PETROBEL, for oil and gas exploration and production in the Sinai Desert. ENI was to be responsible for the technical and financial studies and would recover its cost in crude oil allotments.

The General Petroleum Company (GPC), owned totally by the Egyptian Government, produced a small amount of oil from its seven fields in the Eastern Desert. Oil production from the Umm-el-Yusr North Field began in 1979 at a rate of 2,500 barrels per day. Other small producing companies, all of which operated fields in the Western Desert, were WEPCO, FAPCO, and the Nile Valley Petroleum Co. (NIPCO). In 1978, Agypteco Oil and Gas Exploration Co. (Federal Republic of Germany) signed an agreement to further delineate and develop the Meleiha Field, located near Mersa Matruh in the Western Desert.

Exploration.—Since 1973, Egypt signed a total of 53 agreements with about 30 foreign oil companies for onshore and offshore oil exploration. Under production-sharing agreements, the companies committed a total of $970 million for exploration work for the years 1974 to 1982 covering an acreage of nearly 500,000 square kilometers. In 1978 and 1979, 13 new agreements were concluded. It was estimated that by yearend 1978, $400 million of the total commitment had been expended on exploration activities.

The Gulf of Suez Basin proved to be the most prospective area for oil finds with several new structures discovered in 1978 and 1979. Deminex (Federal Republic of Germany) planned to develop its discovery in the North Belayim offshore concession area, which was estimated to contain recoverable oil reserves of 400 million barrels. The Egyptian Petroleum Development Co. (Epecico) (Japan) planned to start commercial production for its West Bakr discovery in mid-1980. New agreements were signed with Quintana (United States) for a 135-square-kilometer tract at East Shvkheir; the International Egyption Oil Co.(IEOC), a joint venture of EGPA and ENI, for a 2,400 square kilometer with a concession offshore Port Said and the Compagnie Francaise des Petroles for a 400-square-kilometer tract at Nabwi.

The Egyptian Government enacted provisions to increase exploration efforts in the Western Desert, which covered 500,000 square kilometers south of the Mediterranean Coast. Under new production-sharing agreements, oil companies would recover all approved development costs within 1 year from the date of expenditure from crude oil allocations; remaining output would be shared equally with EPGA. Shell Winning N.V., a subsidiary of Royal Dutch/Shell, signed an exploration agreement for a

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32,700-square-kilometer area near the Qattara Depression. Other exploration areas included the Nile Delta, the Nile Basin, the Red Sea, and the Eastern Desert. In the Nile Delta, ELF-ERAP (France) encountered a substantial gas find in its 2,600-square-kilometer concession area. Further drilling was underway and the company was reported to be considering a project for the production of liquified natural gas.

In 1979, Israel returned over 22,000 square kilometers both onshore and offshore northern Sinai. Egypt had already concluded several exploration agreements for this area and the remainder was opened to bidding in 1,200-square-kilometer blocks. Conoco Suez Ltd. obtained an 866-square-kilometer tract in the al-Qa Plain near al-Tur in southwest Sinai. British Petroleum Ltd. (BP) signed a production-sharing agreement for a 700-square-kilometer area near Ras Muhammad and pledged to spend $19 million over an 8-year period.

Refining.—Approximately 50% of Egypt's petroleum production was refined locally in six refineries operated by three public companies. Some petroleum products were imported from Italy, Greece, and France. Refining capacity was to be increased from 85 million barrels per year to 110 million barrels per year by 1980 when Egypt would become a net exporter of petroleum products. Capacities of Egypt's refineries were as follows:

Company	Location	Capacity (thousand barrels per year)
Suez Petroleum Co	Suez	10,000
	Musturud	25,000
	Tanta	10,000
El Nasr Petroleum Co	Suez	7,000
	Amreya	15,000
Alexandria Petroleum Co	Alexandria	15,000

In 1978, Alexandria Petroleum Co. contracted C.E. Lummus Inc. to provide basic engineering services for a lubricating oil complex to be constructed near its refinery. The $100 million plant was to have an annual product of 84,000 tons of lube oil, 16,000 tons of cylinder oil, 100,000 tons of asphalt, and 11,000 tons of microwax.

Several petrochemical projects were also under study. The Petrochemical Projects Group contracted Montedison (Italy) for design and engineering work for a petrochemical industry to be located in Amreya. Using naptha and propane as feedstock, the plant was to produce 100,000 tons of low-density polyethylene, 30,000 tons of high-density polyethylene, and 60,000 tons of polyvinyl chloride per year.

A new plant was to be constructed in Musturud to produce paraxylene from Musturud refinery reformate. Production of 40,000 tons per year was scheduled for 1982. The paraxylene would be used by the Amreya petrochemicals complex in the production of synthetic fibers. The El Nasr Petroleum Co. awarded Badger Ltd. a contract for technical and economic studies for a carbon black manufacturing facility. At present, all Egypt's carbon black requirements are imported. Located in Alexandria, the plant would have a 10,000-ton-per-year capacity.

Pipelines.—The second line of the SUMED pipeline was inaugurated in September 1978, bringing total capacity to 590 million barrels per year. Construction work on the twin 320-kilometer, 42-inch pipeline began in April 1974. SUMED was operated by the Arab Petroleum Pipeline Co. owned by EGPA (50%), Saudi Arabia (15%), Kuwait (15%), the United Arab Emirates (15%), and Qatar (5%). The pipeline, which connected Suez and Alexandria on the Mediterranean, operated at a rate of 1.4 million barrels per day in 1978 and 1.6 million barrels per day in 1979. Almost 50% of the pipeline's capacity was reserved by seven major oil companies. Saudi Arabia also indicated interest in using the SUMED pipeline in conjunction with its new Abqaiq-Yanbu transpeninsular line to ship Saudi crude oil to Western Europe. Beginning in 1982, Saudi Arabia would put through the SUMED pipeline up to 1 million barrels per day of oil under a service contract.

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[1] Economist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Egyptian pounds(£E) to US Dollars at the unitary rate of £E1.00=US$1.43 which went into effect on January 1, 1979.

The Mineral Industry of Finland

By Joseph B. Huvos[1]

In 1979 Finland's gross domestic product was boosted by 7% to $47 billion[2] [3] by a 10% increase in exports, mainly forestry products, but the level of activities in mining and quarrying was not significantly changed. Mining and quarrying contributed to about 1.5% to the gross national product. The entire mineral industry, including processing of mineral and other manufacturing, contributed about 31%. Inflation was down to under 8%, and efforts were focused on lowering the 6.2% unemployment rate.

There were several important events in the Finnish mineral industry. Operations started at Outokumpu Oy's Vammala metal mine, Rautaruukki Oy's Mustavaara iron ore-vanadium pentoxide mine, the Olikluoto nuclear powerplant, and at a dolomite mine. Rautaruukki Oy continued construction under contract at the Kostamus mine in the U.S.S.R., from which it was to receive iron pellets; construction also continued at Kemira Oy's Siilinjärvi apatite mine.

In order to replenish the diminishing reserves of ores and minerals, the Ministry for Trade and Industry has launched a 3-year prospecting competition, as a result of which several promising ore deposits have been found, mostly in central and eastern Finland, in particular at Pielavesi, Keitele, Kiuruvesi, and Rautavaara. The deposits contain iron, nickel, copper and chromium.

PRODUCTION AND TRADE

Production of mineral commodities in 1976, 1977, 1978, and 1979 is shown in table 1. For the third consecutive year Finland ran a trade and a current account surplus. The U.S.S.R., Sweden, and the United Kingdom were the country's largest trading partners. Finland's mineral commodity trade in 1977 and 1978 are shown in tables 2 and 3.

Table 1.—Finland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum metal, secondary	6,100	7,400	7,000	[1]8,000
Cadmium metal, refined	428	527	611	600
Chromium: Chromite:				
Gross weight:				
Concentrate	143,302	145,131	160,865	170,000
Foundry sand	31,567	23,740	17,559	20,000
Cr_2O_3 content:				
Concentrate	57,894	59,939	66,116	70,000
Foundry sand	14,679	11,087	8,200	10,000
Cobalt:				
Mine output, metal content	[r]1,278	1,227	1,296	[1]1,197
Metal, refined	892	985	922	800

See footnotes at end of table.

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Table 1.—Finland: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS —Continued				
Copper:				
Mine output, metal content	41,729	46,728	46,865	[1]41,063
Metal:				
Primary:				
Blister	51,516	61,542	53,737	46,700
Electrolytic	38,149	42,755	42,719	[1]43,027
Secondary (unrefined)	9,527	10,563	9,990	9,200
Gold metal troy ounces	26,299	27,392	29,096	[1]28,325
Iron and steel:				
Iron ore, marketable, all types:				
Gross weight thousand tons	1,167	1,141	1,088	[1]1,149
Fe content do	768	753	712	738
Metal.				
Pig iron do	1,329	1,763	1,916	[1]2,073
Ferroalloys: Ferrochromium do	40	34	45	44
Steel, crude:				
Ingots do	1,614	2,171	2,304	2,300
Castings do	30	25	29	30
Semimanufactures, rolled do	1,616	1,518	1,804	1,800
Lead, mine output, metal content	1,131	628	790	1,000
Mercury 76-pound flasks	383	630	1,145	1,200
Nickel:				
Mine output, metal content	6,358	5,837	4,407	5,800
Nickel sulfate, metal content	190	223	173	NA
Metal, electrolytic	7,624	9,447	7,501	11,500
Platinum metal[e] troy ounces	600	640	640	720
Selenium metal kilograms	9,931	11,654	16,830	18,000
Silver metal troy ounces	773,256	812,898	1,133,151	[1]1,028,000
Titanium concentrate: Ilmenite:				
Gross weight	122,600	124,700	131,900	130,000
Ti content	56,028	56,240	59,750	60,000
Vanadium (V_2O_5):				
Gross weight	2,589	3,328	5,007	4,800
V content	1,450	1,864	2,805	2,800
Zinc:				
Mine output, metal content	61,143	62,856	52,923	[1]51,623
Metal	110,633	137,980	132,935	[1]147,064
NONMETALS				
Cement, hydraulic thousand tons	1,825	1,712	1,704	[1]1,749
Feldspar	68,213	71,890	71,330	70,000
Lime	250,000	235,000	194,101	200,000
Nitrogen, N content of ammonia	168,100	131,400	149,900	155,000
Phosphates, natural: Apatite	4,187	2,550	4,218	4,500
Pyrite, gross weight	494,118	295,015	215,765	210,000
Sodium compounds: Sodium sulfate	63,000	45,000	50,000	45,000
Stone:				
Limestone and dolomite:				
For cement manufacture thousand tons	2,394	2,535	2,287	[1]2,339
For lime manufacture do	462	480	387	[1]439
For sulfite and metallurgical use do	128	98	81	[1]80
Other do	1,267	901	1,055	[1]1,017
Quartz do	109	119	145	[1]217
Sulfur:				
S content of pyrite do	234	130	87	85
Byproduct:				
Of metallurgy do	283	280	232	270
Of petroleum do	25	25	30	30
Total do	542	435	349	385
Talc	[r]148,531	156,584	195,159	200,000
Wollastonite	6,165	8,904	7,688	[1]10,576
MINERAL FUELS AND RELATED MATERIALS				
Peat:				
For fuel use thousand tons	360	600	1,870	1,350
For agriculture and other uses do	198	231	208	210
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	14,235	15,630	16,737	[1]17,508
Jet fuel do	1,554	1,582	1,765	[1]1,806
Kerosine do	30	34	29	[1]40
Distillate fuel oil do	23,990	29,060	26,993	[1]28,000
Residual fuel oil do	27,255	27,330	24,707	[1]24,997
Liquefied petroleum gas do	1,007	1,163	8,468	[1]1,188
Other do	5,506	8,539		[1]8,477
Refinery fuel and losses do	8,203	5,269	4,629	[1]5,035
Total do	81,780	88,607	83,328	[1]87,051

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.
[1]Reported figure.

Table 2.—Finland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum metal including alloys:			
Scrap	18	644	All to West Germany.
Unwrought	3,248	2,652	Japan 1,251; Sweden 978; United Kingdom 319.
Semimanufactures	17,557	38,580	Denmark 3,800; Norway 3,298; United Kingdom 2,819.
Cadmium metal including alloys, all forms	472	507	Italy 151; United Kingdom 114; United States 111.
Chromium: Chromite	508,305	364,461	Sweden 292,300; United States 41,945; Canada 13,084.
Cobalt metal including alloys, unwrought and semimanufactures	999	853	United States 244; United Kingdom 181; Canada 163.
Copper metal including alloys:			
Scrap	338	218	Denmark 159; Sweden 29; Italy 15.
Unwrought, including matte	37,328	17,542	East Germany 7,463; West Germany 5,222; United States 878.
Semimanufactures	21,039	26,865	United Kingdom 5,219; Sweden 4,912; France 3,181.
Gold metal, unworked or partly worked troy ounces	3,569	4,710	West Germany 2,633; Netherlands 833; Sweden 421.
Iron and steel:			
Ore and concentrate, except roasted pyrite	1,165	13,302	Netherlands 5,197; United Kingdom 5,160; West Germany 2,922.
Metal:			
Scrap	3,235	973	Mainly to West Germany.
Pig iron, spiegeleisen, similar materials	71,879	[1]1,696	West Germany 990; Poland 699.
Ferroalloys	27,009	42,802	Sweden 17,960; West Germany 11,519.
Steel, primary forms	214,188	187,452	Sweden 65,782; Ecuador 54,539; United Kingdom 30,647.
Semimanufactures	742,247	998,248	United States 192,791; West Germany 178,983; Sweden 174,066.
Lead:			
Ore and concentrate	--	2,022	West Germany 1,980; Denmark 42.
Metal including alloys:			
Scrap	65	342	West Germany 301; Sweden 41.
Unwrought	1,303	808	Denmark 382; Sweden 237; United Kingdom 100.
Semimanufactures	36	214	Norway 92; Iceland 61; Austria 25; Sweden 19.
Mercury 76-pound flasks	336	403	Belgium-Luxembourg 220; United States 72; Sweden 49.
Nickel metal including alloys:			
Unwrought	7,928	5,882	United States 1,631; France 1,541; United Kingdom 847.
Semimanufactures	30	11	Ecuador 4; Portugal 4; Sweden 3.
Platinum-group metals including alloys troy ounces	939	13	NA.
Silver metal including alloys thousand troy ounces	577	722	Sweden 411; West Germany 211; Netherlands 64.
Tin metal including alloys:			
Scrap	40	79	West Germany 39; United Kingdom 28; Sweden 12.
Unwrought	46	4	Sweden 3.
Semimanufactures	1	1	NA.
Titanium oxides	5,010	2,264	Mainly to Sweden, United States, Hungary.
Vanadium compounds	3,450	4,931	West Germany 1,744; Sweden 1,016; United Kingdom 735.
Zinc:			
Oxide	226	596	Israel 581; Nigeria 10.
Metal including alloys:			
Scrap	474	6	NA.
Unwrought	124,165	113,605	United Kingdom 39,847; United States 24,788; Sweden 14,931.
Semimanufactures	159	65	U.S.S.R. 41; Sweden 11; United Kingdom 10.
Other:			
Ash and residue containing nonferrous metals	942	1,929	West Germany 791; United Kingdom 435; Belgium-Luxembourg 326.
Waste and sweepings of precious metals kilograms	8,924	11,254	France 4,864; West Germany 2,466; Sweden 2,001.
Base metals, n.e.s	3	1	All to West Germany.

See footnotes at end of table.

Table 2.—Finland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	(2)	--	
Grinding and polishing wheels and stones	50	36	Brazil 19; Sweden 9; Saudi Arabia 2.
Asbestos	3	--	
Cement	36,673	76,665	Sweden 43,644; U.S.S.R. 31,413; Norway 1,175.
Chalk	(2)	65	All to Nigeria.
Clays and clay products (including all refractory brick):			
Crude:			
Kaolin	--	114	Sweden 112.
Other	470	714	Sweden 651; Iraq 4.
Products:			
Refractory	171	2,154	U.S.S.R. 1,340; Sweden 335; United Kingdom 306.
Nonrefractory	273	230	Sweden 111; U.S.S.R. 81.
Diamond, natural and manufactured, gem and industrial carats	1,250	200	Mainly to Sweden.
Diatomite and other infusorial earth	8	8	NA.
Feldspar, leucite, nepheline syenite	52,466	54,082	United Kingdom 33,064; West Germany 4,981.
Fertilizer materials, manufactured:			
Nitrogenous	3,301	41,149	Mexico 14,680; Turkey 12,000; Hungary 11,745.
Phosphatic	--	7	NA.
Potassic	18,671	NA	All to Cuba and Morocco.
Other, including mixed	10,576	120,542	China, mainland, 36,050; Thailand 22,512; Philippines 18,500.
Lime	73	318	U.S.S.R. 226.
Precious and semiprecious stones, except diamond:			
Natural kilograms	1,127	1,666	United States 1,323; Sweden 141; West Germany 120.
Manufactured do.	(2)	1	Mainly to United Kingdom.
Salt, excluding brine	7	52	Mainly to U.S.S.R.
Sodium compounds, n.e.s.: Caustic soda	--	3	NA.
Stone, sand and gravel:			
Dimension stone	78,079	101,309	Italy 47,146; France 22,909; West Germany 12,300.
Dolomite	34	--	
Limestone	14,953	11,103	Sweden 9,817; Denmark 1,108; West Germany 100.
Quartz and quartzite	1,433	1,086	Norway 518; Sweden 318; Iran 240.
Crushed and broken stone and gravel	17,684	134,473	Sweden 127,157; U.S.S.R. 7,260.
Sand, excluding metal bearing	31,124	90,846	Sweden 88,978; U.S.S.R. 999; Iran 775.
Sulfur:			
Elemental, all forms	1,633	8	NA.
Sulfuric acid	223,004	113,128	Netherlands 49,128; West Germany 24,532; Spain 11,888.
Talc and steatite	31,876	27,609	Sweden 7,363; Poland 6,565; U.S.S.R. 3,163.
Other:			
Crude, unspecified	9,912	6,254	West Germany 2,158; Spain 1,253; Italy 824.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	--	30	NA.
Slag and ash, n.e.s	(2)	13	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	436	All to U.S.S.R.
Carbon black	8	11	Mainly to Nigeria.
Coal, anthracite	5	--	
Hydrogen, helium, rare gases kilograms	500	1,400	Saudi Arabia 1,100.
Peat, including peat briquets and litter	13,047	17,241	Netherlands 5,374; Libya 2,708; United Kingdom 2,447.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	12	4,923	Sweden 3,038; United Kingdom 646; Netherlands 540.
Kerosine do.	(2)	(2)	NA.
White spirit do.	636	471	Netherlands 212; Belgium-Luxembourg 109; United Kingdom 108.
Jet fuel do.	--	154	All to Sweden.
Distillate fuel oil do.	561	3,950	Sweden 2,072; West Germany 935; Denmark 391.
Residual fuel oil do.	5,770	3,459	Sweden 1,965; Denmark 976; United Kingdom 417.

See footnotes at end of table.

Table 2.—Finland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum refinery products —Continued			
Lubricants thousand 42-gallon barrels	95	124	U.S.S.R. 57; Nigeria 50; France 11.
Other:			
Liquefied petroleum gas do	5	64	United Kingdom 40; France 14; Denmark 7.
Mineral jelly and wax do	32	12	Sweden 7; West Germany 3; Norway 1.
Nonlubricating oils, n.e.s do	4	4	Sweden 3.
Bitumen and bituminous mixtures, n.e.s do	15	3	U.S.S.R. 2.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1	--	

NA Not available.
[1] Excludes quantity valued at $11,859,654.
[2] Less than 1/2 unit.

Table 3.—Finland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Ore and concentrate	76	265	Denmark 177; West Germany 88.
Oxide and hydroxide	17,820	24,333	Hungary 14,049; China, mainland, 4,907; West Germany 2,559.
Metal including alloys:			
Unwrought	28,550	21,724	U.S.S.R. 8,350; Norway 4,598; Hungary 3,771.
Semimanufactures	25,051	24,410	Sweden 5,915; West Germany 4,793; Norway 2,850.
Antimony metal including alloys, all forms	5	39	Denmark 20; Yugoslavia 4; Belgium-Luxembourg 3.
Arsenic trioxide, pentoxide, acids	773	--	
Beryllium metal including alloys, all forms kilograms	(1)	100	All from Sweden.
Cadmium metal including alloys, all forms do	100	13,300	Canada 12,400.
Chromium:			
Chromite	5,285	--	
Oxide and hydroxide	527	296	Poland 100; U.S.S.R. 91; West Germany 73.
Cobalt:			
Oxide and hydroxide	52	15,252	East Germany 14,492.
Metal including alloys, all forms	126	306	Netherlands 301.
Copper:			
Ore and concentrate	11,813	4,192	Canada 2,708; Cuba 1,482.
Copper sulfate	1,436	368	West Germany 149; United Kingdom 88; U.S.S.R. 56.
Metal including alloys:			
Scrap	171	366	United States 296; Sweden 69.
Unwrought	10,508	14,333	West Germany 6,732; U.S.S.R. 5,006; Zambia 865.
Semimanufactures	8,528	7,859	Sweden 3,069; West Germany 1,716; United Kingdom 1,547.
Gold metal, unworked or partly worked troy ounces	76,191	67,333	West Germany 27,135; United Kingdom 20,056; Switzerland 6,282.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	1,166	1,530	Sweden 1,010; U.S.S.R. 329; Norway 166.
Metal:			
Scrap	63,215	22,832	U.S.S.R. 22,783.
Pig iron, including cast iron	548	2,212	Sweden 1,365; Canada 606; Norway 140.
Sponge iron, powder, shot	3,765	4,303	Sweden 2,234; United Kingdom 776; Spain 677.
Ferroalloys	26,670	33,030	Norway 14,948; U.S.S.R. 11,184; Sweden 2,158.
Steel, primary forms	10,338	15,726	Sweden 14,639.
Semimanufactures:			
Bars, rods, angles, shapes, sections	130,958	140,873	Sweden 44,095; West Germany 15,939; Czechoslovakia 14,791.
Universals, plates, sheets	140,521	99,587	Sweden 21,069; West Germany 18,048; Czechoslovakia 15,473.
Hoop and strip	25,354	23,811	West Germany 6,881; United Kingdom 5,045; Sweden 4,996.

See footnotes at end of table.

Table 3.—Finland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Semimanufactures —Continued			
Rails and accessories	1,809	2,752	West Germany 1,696; Sweden 398; Belgium-Luxembourg 358.
Wire	11,983	11,570	Sweden 3,000; France 2,492; Belgium-Luxembourg 1,492.
Tubes, pipes, fittings	74,970	83,956	West Germany 20,476; United Kingdom 13,752; Sweden 8,711.
Lead:			
Oxides	108	152	East Germany 90; West Germany 53; United States 7.
Metal including alloys:			
Unwrought	14,612	12,332	U.S.S.R. 6,242; Sweden 5,607.
Semimanufactures	566	637	Denmark 316; West Germany 185; United Kingdom 55.
Magnesium metal including alloys, all forms	210	89	Norway 69; West Germany 12; United Kingdom 7.
Manganese:			
Ore and concentrate	17,297	19,737	Netherlands 9,964; Republic of South Africa 9,428.
Oxides	1,293	2,068	China, mainland, 1,020; Netherlands 810; Belgium-Luxembourg 121.
Mercury 76-pound flasks	281	316	Sweden 174; Spain 130.
Molybdenum:			
Ore and concentrate	269	40,111	United States 27,706; Sweden 12,349.
Metal including alloys, all forms	91	2	Mainly from Austria and United States.
Nickel:			
Ore and concentrate	13,193	14,275	All from Norway.
Metal including alloys:			
Scrap	1,749	924	United States 618; United Kingdom 86; West Germany 80.
Unwrought	3,284	4,547	United States 1,553; French Oceania 1,451; Australia 797.
Semimanufactures	112	49	Australia 14; West Germany 11; United States 11.
Phosphorus, elemental	2	8	West Germany 5.
Platinum-group metals troy ounces	6,023	7,867	France 4,501; United Kingdom 1,582; Sweden 1,328.
Silver metal including alloys thousand troy ounces	1,851	1,564	West Germany 641; United Kingdom 594; Sweden 187.
Silicon, elemental	402	441	Sweden 420; Norway 20.
Tin:			
Oxides	1	--	
Metal including alloys:			
Scrap	--	13	All from United States.
Unwrought	121	211	West Germany 76; United Kingdom 44; Sweden 40.
Semimanufactures	110	111	United Kingdom 81; West Germany 15; Norway 5.
Titanium:			
Ore and concentrate	10,368	6,399	Norway 4,980; Republic of South Africa 971; Australia 253.
Oxides	71	95	United States 59; Norway 18; West Germany 15.
Tungsten:			
Ore and concentrate	2	(1)	NA.
Metal including alloys, all forms	31	29	United States 14; West Germany 10.
Zinc:			
Ore and concentrate	127,162	169,199	Denmark 82,355; Sweden 52,687; Peru 34,157.
Oxides	245	347	United Kingdom 218; Sweden 54; Canada 42.
Metal including alloys:			
Scrap	21	--	
Blue powder	284	459	Norway 404; United Kingdom 55.
Unwrought	1,533	197	West Germany 138; United Kingdom 33; Belgium-Luxembourg 10.
Semimanufactures	491	671	Norway 417; United Kingdom 82; Sweden 59.
Zirconium ore and concentrate	7	3,067	NA.
Other:			
Ores and concentrates	171	860	All from Norway.
Ash and residue containing nonferrous metals	2,344	2,566	United States 1,650; Sweden 672; United Kingdom 108.
Metals including alloys, all forms:			
Metalloids, n.e.s.	13	4	Mainly from West Germany and Japan.

See footnotes at end of table.

Table 3.—Finland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Other —Continued			
Metals including alloys, all forms —Continued			
Pyrophoric alloys	1	--	
Base metals, n.e.s	136	140	Sweden 67; Republic of South Africa 37; Denmark 18.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	88	101	Italy 40; West Germany 26; United Kingdom 11.
Dust and powder of precious and semiprecious stones, except diamond kilograms	5	3	NA.
Grinding and polishing wheels and stones	1,666	1,667	Sweden 312; United States 312; Austria 289.
Asbestos	5,624	5,415	U.S.S.R. 2,435; Canada 1,694; Republic of South Africa 776.
Barite and witherite	1,154	952	West Germany 731; United Kingdom 120; China, mainland, 60.
Borates, crude, natural	12,812	15,748	United States 8,445; Turkey 7,300.
Cement	6,265	7,056	Denmark 4,224; U.S.S.R. 1,163; United Kingdom 888.
Chalk	12,692	9,286	West Germany 3,715; United Kingdom 2,049; Denmark 2,014.
Clays and clay products (including all refractory brick):			
Crude:			
Kaolin	361,648	330,644	United Kingdom 317,751; Brazil 8,810; East Germany 2,178.
Other	15,394	22,436	United Kingdom 14,718; United States 3,740; West Germany 3,594.
Products:			
Refractory (including nonclay brick)	57,313	52,235	United Kingdom 15,517; Sweden 10,133; West Germany 9,191.
Nonrefractory	3,157	5,942	U.S.S.R. 5,119; Sweden 755.
Cryolite and chiolite	53	37	Denmark 36.
Diamond, industrial carats	10,750	11,650	Belgium-Luxembourg 5,400; Netherlands 3,650; United Kingdom 850.
Diatomite	1,281	1,295	United States 654; Iceland 280; United Kingdom 203.
Feldspar, leucite, nepheline syenite	162	1,917	Denmark 1,838.
Fertilizer materials:			
Crude, phosphatic	407,366	492,806	U.S.S.R. 127,404; Senegal 101,633; Morocco 98,196.
Manufactured:			
Nitrogenous	24,299	31,609	Norway 9,965; U.S.S.R. 6,057; East Germany 6,004.
Phosphatic	265	204	Mainly from West Germany.
Potassic	240,684	243,382	East Germany 119,652; U.S.S.R. 87,139; West Germany 36,591.
Other, including mixed	699	1,286	Belgium-Luxembourg 720; Sweden 296; United Kingdom 183.
Ammonia	94,326	103,767	U.S.S.R. 52,938; United Kingdom 14,999; Mexico 14,944.
Fluorspar	6,383	2,204	Thailand 1,317; East Germany 338; Sweden 322.
Graphite, natural	181	104	West Germany 48; Norway 30; Sweden 22.
Gypsum and plasters	125,369	83,558	Spain 57,624; U.S.S.R. 20,686; Sweden 3,121.
Lime	26	17	NA.
Magnesite	1,215	7,176	U.S.S.R. 4,466; Netherlands 1,138; Norway 1,083.
Mica, all forms	292	270	United Kingdom 182; West Germany 30; China, mainland, 20.
Pigments, mineral:			
Natural, crude	66	--	
Iron oxides, processed	3,033	2,871	West Germany 2,726.
Precious and semiprecious stones, except diamond:			
Natural kilograms	2,477	2,082	India 800; West Germany 496; Brazil 378.
Manufactured do	100	83	Switzerland 52; West Germany 14; Austria 13.
Salt, excluding brine	482,916	547,251	Netherlands 295,361; Poland 74,200; East Germany 62,458.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	66,067	72,419	West Germany 28,974; Belgium-Luxembourg 20,809; France 19,048.
Caustic potash	456	474	East Germany 240; West Germany 107; Sweden 77.

See footnotes at end of table.

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Table 3.—Finland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	517	1,331	Norway 874; Sweden 121; Italy 52.
Worked	500	359	Sweden 198; Italy 84; Portugal 57.
Dolomite, chiefly refractory grade	18,937	17,540	Belgium-Luxembourg 13,922; Norway 1,716; West Germany 1,448.
Gravel and crushed rock	6,255	5,204	Sweden 2,675; Norway 1,543; Denmark 764.
Limestone, except dimension	607,601	627,693	Sweden 617,787; Spain 5,500; United Kingdom 4,204.
Quartz and quartzite	218	276	Portugal 100; Sweden 69; United States 50.
Sand, excluding metal bearing	53,949	106,037	Norway 62,360; Belgium-Luxembourg 26,969; Denmark 9,300.
Sulfur:			
Elemental	29,696	28,439	France 16,606; Poland 9,175; Sweden 2,300.
Sulfuric acid	175	69	West Germany 33; Belgium-Luxembourg 20; Netherlands 8.
Talc and steatite	656	656	Belgium-Luxembourg 190; Norway 166; United States 67.
Other:			
Crude	14,238	1,800	Republic of South Africa 1,011; Sweden 280; Denmark 176.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	17,693	7,581	Sweden 6,479.
Slag and ash, n.e.s	1,980	2,550	All from Norway.
Oxides and hydroxides of magnesium, strontium, barium	12,670	1,245	East Germany 600; Netherlands 238; U.S.S.R. 174.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	6,327	4,453	Denmark 2,166; Sweden 542; West Germany 518.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	735	414	Trinidad and Tobago 192; United States 123; Sweden 89.
Carbon black and gas carbon:			
Carbon black	6,086	7,338	Sweden 2,756; Netherlands 1,530; West Germany 1,449.
Gas carbon	649	--	
Coal, all grades, including briquets thousand tons	4,287	4,789	Poland 4,089; U.S.S.R. 697.
Coke and semicoke do	894	930	U.S.S.R. 754; West Germany 78; Sweden 57.
Hydrogen, helium, rare gases	504	862	U.S.S.R. 710; West Germany 89; Sweden 36.
Peat, including peat briquets and litter	270	6,924	U.S.S.R. 6,714.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	84,691	76,851	U.S.S.R. 50,454; Saudi Arabia 11,505; Iran 6,942.
Refinery products:			
Gasoline do	169	237	U.S.S.R. 123; Netherlands 78; Denmark 11.
Jet fuel do	23	14	All from United Kingdom.
Kerosine do	51	33	U.S.S.R. 27; United Kingdom 4; Netherlands 1.
Distillate fuel oil do	11,006	10,686	Mainly from U.S.S.R.
Residual fuel oil do	10,359	9,171	Do.
Lubricants do	702	689	United Kingdom 262; U.S.S.R. 143; Netherlands 126.
Other:			
Liquefied petroleum gas do	5,703	6,723	U.S.S.R. 6,704.
White spirit do	636	67	All from Sweden.
Mineral jelly and wax do	128	114	West Germany 37; U.S.S.R. 34; China, mainland, 19.
Nonlubricating oils, n.e.s. do	42	53	Romania 28; United Kingdom 8; West Germany 5.
Bitumen and bituminous mixtures, n.e.s do	335	352	Denmark 164; Netherlands 139; Sweden 38.
Pitch, pitch coke, petroleum coke do	11	7	Mainly from United Kingdom and West Germany.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	218	337	United Kingdom 241; West Germany 54; Denmark 20.

NA Not available.
[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Chromite.—Outokumpu Oy continued production of chromite ore at Kemi on the Gulf of Bothnia from the new Viia open pit mine at a rate of 800,000 tons per year. The former Elijärvi pit nearby has been depleted. The chromite ore averages 26% Cr_2O_3 and has a Cr-to-Fe ratio of 1.55. Total ore reserves are about 20 to 30 million tons.[4] The main product is a concentrate containing 40% to 42% Cr_2O_3, which is used at the company's Tornio ferrochrome plant. Some concentrate containing 45% to 47% Cr_2O_3 and 2% SiO_2 is exported or used for foundry sand.

Recently the Geological Research Institute discovered a new chrome ore deposit at Kotelaisen Kaira in Sodankylä, Finnish Lappland. Several square kilometers are covered by the deposit containing 14% chromium and traces of platinum and palladium.

Copper, Nickel, Lead, and Zinc.—Outokumpu Oy started operations at its Vammala Mine, located east of Pori, Southwest Finland. About 350,000 tons of ore is to be extracted from a deposit expected to last for 10 years. The ore contains 0.7% nickel and 0.4% copper.

Ore mined by Outokumpu decreased in 1978 to 5.8 million tons. Metal production was also slightly lower, with cathode copper amounting to 42,700 tons, cathode nickel to 7,500 tons, zinc to 133,000 tons, and cobalt products to 930 tons. Besides Outokumpu Oy's nine metallic ore mines and processing plants and three smelters (Harjavalta, Pori, Kokkola), Myllikoski Oy operated one copper mine at Luikonlahti, located near Outokumpu, which sold its ores to Outokumpu Oy.

Iron Ore.—Total ore production of Rautaruukki Oy's three mines, Otanmäki, Rautavaara, and Mustavaara, located in northern and central Finland, was 3.8 million tons in 1978, yielding 785,000 tons of iron concentrate. This quantity and imports of 1.5 million tons of iron ore were used by Rautaruukki Oy for making steel at Raahe. Work continued under contract in the U.S.S.R. near the Finnish border at Polvijärvi (Kostamus) on the construction of an iron ore mine and concentrator to supply iron ore pellets to Finland starting in 1980.

Iron and Steel.—Finland's steel production was controlled mainly by Government-owned Rautaruukki Oy (72%) with steelworks at Raahe on the Baltic. Ovako Oy accounted for 23% and the Wartsila concern at Dalsbruk, south Finland, accounted for about 3%. Outokumpu Oy (2% of steel production) controlled the Tornio plant on the Baltic, including production of 44,800 tons of ferrochrome and 44,300 tons of rolled alloyed steel products in 1978.

Vanadium.—In September, Rautaruukki Oy officially opened its Mustavaara vanadium pentoxide mine, located in Suomussalmi municipality. Production was held up in 1977 and early in 1978 by problems in the sintering plant. Output in 1977 was 1,124 tons of vanadium pentoxide, far short of the 3,000 tons per year nominal capacity of the mine. The company's Otanmäki vanadium pentoxide mine, located in Vuolijoki municipality, produced 2,207 tons of pentoxide in 1977. In 1978, total Finnish vanadium pentoxide production was 5,000 tons.

NONMETALS

Apatite.—Development work continued at Kemira Oy's Siilinjärvi apatite mine, north of Kuopio. Test runs at the mine and processing plant were planned for 1979. Capacity of the mine is 2 million tons of ore with an apatite content of 10%. When in production, the mine is to supply about 10% of the country's apatite requirements. Startup is planned for 1980.

Cement.—Paraisten Kalkki Oy operated three cement plants, located at Pargas (south coast), Lappeeranta (southeast), and Kolari (Finnish West Lappland) totaling 1.85 million tons capacity. Oy Lohja AB operated the 850,000-ton Virkby plant near Lohja.

Dolomite.—A dolomite mine was started at Siikainen, north of Pori, southwest Finland. The importance of the 180,000-ton-per-year mine lies in the fact that it supplies magnesium, which is deficient in the soil of west Finland.

Ilmenite.—In 1978, Rautaruukki Oy's Otanmäki iron ore mine produced 132,000 tons of ilmenite concentrate. Domestic ilmenite production and some imported ore were used to make titanium pigment at Kemira Oy's Pori plant. The pigment was mainly exported.

MINERAL FUELS

Hydroelectric power, peat, fuelwood, and industrial waste supplied barely 15% of Finland's energy requirements, the rest was supplied by imports of crude oil, natural gas, nuclear fuel, and coal.

Coal.—Preliminary studies were underway to build a port for bulk coal carriers of 100,000 deadweight tons. This would make it possible for the country to diversify away from imports of Polish coal. No domestic coal is mined in Finland.

Nuclear Power.—Test runs were made at the country's second nuclear powerplant site at Olkiluoto (west coast) on the first of two 660-megawatt units built by the Swedish ASEA-Atom for Immatran Voima Oy (IVO, Electric Utility of Finland). One 440-megawatt unit of two, built at Lovisa (south coast) by the U.S.S.R. has been operating since 1977. Startup of the second Lovisa unit has been postponed until 1980 to correct faults in the pressure vessel.

According to an official study, energy consumption is expected to slow down during the 1980s because of the high cost of energy and strong conservation measures. Consequently, construction of additional nuclear powerplants may be delayed.

Peat.—According to Finland's first energy program, drafted by the Energy Policy Council chaired by the Trade and Industry Minister, the production of peat is to be increased from the present 6 million cubic meters per year to 20 million cubic meters by 1985 to substitute for imports of 2 million tons per year of crude oil.

Petroleum and Natural Gas.—In 1979 Finland had no crude oil production, and the Finnish State oil company, Neste Oy, had a monopoly to import and refine petroleum. The company had two refineries with total capacity of 15 million tons per year, one located at Naantali on the west coast and the other at Porvoo on the south coast.

An official report recommended to increase gas imports from the U.S.S.R. from the present 1 billion cubic meters per year to 2 billion and subsequently to 3 billion cubic meters per year. The present 125-kilometer-long, 28-inch gas pipeline is to be extended from Kouvola to Lahti and later to Helsinki. Neste Oy estimates that gas could reach Lahti by 1981, Tampere in 1984, and Helsinki a year later. At present, there is a 40-kilometer, 16-inch pipeline from Kouvola to Kotka (south coast).

Uranium.—The Geological Research Institute has discovered a deposit of 330,000 tons of uranium ore at Kittilä in Finnish Lappland, assaying an average 0.2% uranium.

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[1] Physical scientist, International Data and Analysis.

[2] U.S. Embassy, Helsinki. State Department Airgram A-65, Nov. 9, 1979, p. 2.

[3] Where necessary, values in Finland Marks (Fmk) were converted to U.S. dollars at the rate of Fmk3.9=US$1.00 for 1977-79.

[4] Mining Magazine. V. 139, No. 6, December 1978, p. 477.

The Mineral Industry of France

By Roman V. Sondermayer[1]

France, which extracts small quantities and has sizable imports of minerals, continued during 1978-79 among the largest processors of minerals and petroleum in Europe. However, activities of the minerals industry, when compared with that of 1977, showed slowdowns in expansions and modernization of mining and processing facilities; mining was fairly significant to the French economy as a source of employment in certain regions.

During 1978 and 1979, France reorganized Government agencies dealing with minerals and announced a new mineral and energy policy. The reorganization was complex and put most of the activities relating to crude materials under the Direction of Générale de l'Energie et de Matières Premières in the Ministry of Industry (Ministère de l'Industrie). The mineral plan and the energy plan both expressed concern about France's dependence on imports of minerals, metals, and energy. In the field of minerals, emphasis was on discovery and development of domestic resources and a goal was set to lower dependency on foreign minerals from 85% to 80% by 1985. In the field of energy, dependence on foreign supplies was to be lowered mostly by development of nuclear energy and to a lesser extent by development of solar energy and by conservation.

Major events in the mineral industry during the years in review were accelerated exploration by the Bureau de Recherches Géologiques et Minières (BRGM); restructuring of the steel industry; startup of a new nickel electrolytic plant, unfortunately damaged by fire; the beginning of pilot production in a new opencast tungsten mine; completion of an aerial tramway in a talc mine; and closure of a petroleum refinery.

PRODUCTION

Table 1 shows the latest figures and trends of the output of French minerals and related products. Private companies and State-owned corporations produced minerals at home and abroad. The Government-owned BRGM remained an important instrument of the Government in securing raw materials for the domestic economy by exploration and ventures abroad.

Table 1.—France: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^{p}	1979^{e}
METALS				
Aluminum:				
Bauxite, gross weight __ thousand tons__	2,330	2,059	1,990	2,000
Alumina:				
Crude ________________do____	1,184	1,242	1,221	1,200
Calcined ______________do____	1,020	1,081	1,056	1,075

See footnotes at end of table.

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Table 1.—France: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS —Continued				
Aluminum —Continued				
Metal:				
Primary thousand tons	385	400	391	385
Secondary do	133	146	157	150
Antimony metal, smelter	4,500	4,562	5,205	5,200
Arsenic, white	[r]7,278	[r][e]7,250	[e]7,250	7,250
Bismuth:[1]				
Ore and concentrate, metal content kilograms	100,000	[r][e]85,000	90,000	45,000
Metal do	68,000	[r][e]50,000	50,000	60,000
Cadmium metal	532	790	694	790
Chromium metal	847	NA	NA	NA
Cobalt metal	[2]	--	--	--
Copper:				
Mine output, metal content	500	300	600	600
Metal:				
Blister, secondary	2,200	5,300	6,400	7,000
Refined:				
Primary	[r]19,296	22,337	20,672	22,000
Secondary	20,082	22,708	21,316	23,250
Total	[r]39,328	45,045	41,988	[2]45,250
Gold:				
Mine output, metal content troy ounces	61,022	50,444	59,640	60,000
Metal[e] do	61,000	50,000	59,000	59,000
Iron and steel:				
Iron ore and concentrate:				
Gross weight thousand tons	45,181	36,630	33,458	31,000
Metal content do	13,792	11,050	10,820	10,100
Metal:				
Pig iron do	18,657	17,884	18,101	[2]19,416
Ferroalloys:				
Blast furnace: Spiegeleisen and ferromanganese do	367	378	396	380
Electric furnace:				
Ferromanganese do	12	21	19	19
Ferrosilicon do	237	241	193	200
Ferrochrome do	101	104	96	95
Other do	98	96	125	120
Total do	448	462	433	434
Steel ingots and castings do	23,221	22,094	22,841	[2]23,364
Semimanufactures do	19,459	20,196	21,839	NA
Lead:				
Mine output, metal content	28,000	31,480	32,500	29,000
Metal, refined:				
Primary	118,406	126,985	125,892	[2]129,063
Secondary	[r]17,400	18,320	13,452	22,000
Antimonial lead (Pb content)	[r]52,900	56,930	68,848	70,646
Total	[r]188,706	202,235	208,192	[2]221,709
Magnesium metal, including secondary	8,006	8,683	8,500	9,000
Nickel metal, Ni content of metallurgical products (pure nickel, ferronickel, nickel oxide)	12,313	10,279	7,878	3,500
Silicon	[r]41,313	42,580	[e]43,000	44,000
Silver:				
Mine output, metal content thousand troy ounces	2,806	3,004	2,754	2,400
Metal, Ag content of final smelter products do	3,677	7,060	[e]5,800	3,000
Tungsten concentrate, metal content	[r]633	653	608	500
Uranium:				
Mine output, metal content	2,111	2,236	2,561	2,600
Chemical concentrate, U_3O_8 equivalent	[r]2,477	2,749	2,921	3,000
Zinc:				
Mine output, metal content	34,700	41,830	39,900	35,900
Metal, including secondary:				
Slab	[r]233,254	238,273	231,212	[2]248,977
Dust	7,460	9,790	8,500	9,000
NONMETALS				
Barite	150,000	220,000	225,000	226,000
Bromine, elemental	15,180	15,570	[e]16,000	15,000

See footnotes at end of table.

Table 1.—France: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^{p}	1979^{e}
NONMETALS —Continued				
Cement, hydraulic ______ thousand tons__	29,394	28,830	28,025	28,824
Clays:				
Bentonite[4] ____________________	17,297	$^{r\,e}$17,000	^{e}17,000	22,000
Brick and tile clay ____ thousand tons__	9,790	$^{r\,e}$10,000	^{e}10,000	NA
Ceramic and potter's clay______do____	655	^{e}700	^{e}700	NA
Clay and marl for cement manufacture do____	12,538	^{e}13,000	^{e}13,000	NA
Kaolin and kaolinitic clay (marketable) do____	^{r}274	280	254	250
Kyanite and andalusite ____________	18,131	$^{r\,e}$20,000	^{e}20,000	NA
Refractory clay, unspecified _________	848,620	^{e}900,000	^{e}900,000	NA
Diatomite ______________________	210,255	^{e}200,000	^{e}200,000	200,000
Feldspar, crude____________________	188,000	192,000	^{e}190,000	190,000
Fluorspar:				
Crude ______________________	675,000	531,600	529,600	530,000
Marketable^{e} ___________________	^{r}306,000	283,000	315,000	315,000
Gypsum and anhydrite, crude thousand tons__	6,630	6,032	6,036	5,900
Lime: Quicklime, hydrated lime, and dead burned dolomite ______________do____	4,648	4,468	^{e}4,600	3,700
Mica ______________________	^{e}6,500	^{re}7,000	7,300	7,000
Pigments, mineral, natural: Iron oxides ____	11,024	$^{r\,e}$11,000	^{e}11,000	12,700
Phosphates:				
Phosphate rock (phosphatic chalk) _____	28,250	19,340	24,500	25,000
Thomas slag________ thousand tons__	2,298	1,990	2,041	NA
Potash:				
Gross weight (run-of-mine) _____do____	10,272	10,593	11,667	12,000
K_2O equivalent (run-of-mine) ___do____	1,738	1,719	1,928	1,980
K_2O equivalent (marketable) ___do____	^{r}1,603	1,580	1,795	1,850
Pozzolan and lapilli ________________	638,000	702,000	588,000	590,000
Quartz and glass sand:				
Quartz[5] ______________________	462,823	^{e}500,000	^{e}500,000	NA
Glass sand_________ thousand tons__	6,336	6,000	6,252	NA
Salt:				
Rock salt______________do____	280	287	458	580
Brine salt ______________do____	1,067	1,016	1,102	1,200
Marine salt ______________do____	1,431	557	865	900
Salt in solution ____________do____	3,300	3,490	4,100	4,200
Total______________do____	6,078	5,350	6,525	6,880
Sodium compounds:				
Sodium sulfate ____________do____	130	119	125	140
Sodium carbonate ___________do____	1,316	1,364	1,353	1,356
Stone, sand and gravel:				
Building stone:				
Granite and similar stone___do____	936	NA	NA	NA
Limestone ______________do____	819	NA	NA	NA
Marble ______________do____	214	NA	NA	NA
Crushed limestone and granite do____	6	NA	NA	NA
Other ______________do____	12,895	NA	NA	NA
Dolomite:				
For agriculture ______________	413,001	NA	NA	NA
Crude, for calcining ___________	352,257	NA	NA	NA
Other ____________________	253,637	NA	NA	NA
Total ____________________	1,018,895	NA	NA	NA
Limestone, agricultural and industrial:				
For agriculture ___ thousand tons__	926	NA	NA	NA
For iron and steel manufacture do____	3,573	NA	NA	NA
For lime and cement manufacture do____	25,617	NA	NA	NA
For sugar mills __________do____	847	NA	NA	NA
Total ______________do____	30,963	NA	NA	NA
Roadbuilding, foundation, and ballast material (except alluvial sand and gravel):				
Ballast ______________do____	140,618	NA	NA	NA
Foundation material________do____	6,121	NA	NA	NA
Ground rock for road filler __do____	413	NA	NA	NA
Paving block and curbing ___do____	81	NA	NA	NA
Slate:				
Roof______________do____	129	NA	NA	NA
Other ______________do____	33	NA	NA	NA

See footnotes at end of table.

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Table 1.—France: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Other stone:				
Beach pebble ---- thousand tons	103	NA	NA	NA
Marl ---- do	287	NA	NA	NA
Mine fill ---- do	8,295	NA	NA	NA
Sand and gravel:				
Industrial sands:				
Foundry ---- do	1,090	NA	NA	NA
Miscellaneous ---- do	1,456	NA	NA	NA
Other sand and gravel (alluvial) do	[r]259,208	226,000	206,200	290,000
Sulfur, byproduct:				
Of natural gas ---- do	1,737	1,911	1,970	2,000
Of petroleum ---- do	88	89	90	90
Of unspecified sources ---- do	143	160	160	160
Total ---- do	1,968	2,160	2,220	2,250
Talc:				
Crude ----	246,300	299,500	NA	NA
Powder ----	255,800	286,500	303,492	317,000
MINERAL FUELS AND RELATED MATERIALS				
Asphaltic material[6] ----	94,180	82,270	[e]82,000	NA
Carbon black[e] ----	170,000	170,000	170,000	180,000
Coal, including briquets:				
Anthracite ---- thousand tons	4,811	4,188	3,871	
Bituminous coal ---- do	17,068	17,106	15,819	[3]18,617
Lignite ---- do	3,188	3,080	2,732	[3]2,448
Total ---- do	25,067	24,374	22,422	[3]21,065
Briquets ---- do	2,516	2,222	2,175	2,000
Coke, metallurgical ---- do	11,312	10,770	10,682	10,500
Gas, natural:				
Gross ---- million cubic feet	369,854	393,368	398,517	393,000
Marketed ---- do	250,450	271,745	277,741	[3]273,687
Natural gas liquids:				
Natural gasoline and condensate thousand 42-gallon barrels	3,956	4,215	4,194	4,100
Propane ---- do	1,608	1,717	1,751	1,340
Butane ---- do	1,781	2,008	1,804	2,130
Total ---- do	7,345	7,940	7,749	7,570
Peat ---- thousand tons	142	[r][e]140	[e]140	140
Petroleum:				
Crude ---- thousand 42-gallon barrels	7,710	7,557	8,147	[3]8,744
Refinery products:				
Gasoline:				
Aviation ---- do	335	258	436	[3]348
Motor ---- do	152,527	149,728	153,842	[3]161,670
Jet fuel ---- do	28,099	28,591	32,832	[3]35,192
Kerosine ---- do	866	770	705	[3]884
Distillate fuel oil ---- do	309,401	303,920	302,436	[3]326,710
Residual fuel oil ---- do	243,617	240,783	239,820	[3]246,540
Lubricants ---- do	8,909	9,364	10,276	[3]10,427
Other:				
Liquefied petroleum gas ---- do	[r]33,811	34,785	33,860	[3]33,480
Bitumen ---- do	[r]21,743	20,268	19,956	[3]20,150
Unspecified ---- do	[r]49,096	32,348	82,755	87,950
Refinery fuel and losses ---- do	53,793	52,689	50,771	[3]54,601
Total ---- do	902,197	873,504	927,689	978,651

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] Although output reported is at the smelter stage of production rather than at the mine stage and thus could include metal contained in ores mined in other countries, it is believed that any such production derived from ores from other countries is not duplicative to any significant extent of mine production reported for other countries.

[2] Revised to none.

[3] Reported figure.

[4] Includes smectic clay.

[5] Includes material for the glass industry as well as for ceramic use.

[6] Excludes bituminous material.

TRADE

Tables 2 and 3 show details on foreign trade of France for the latest years for which complete data were available. Mineral fuels, petroleum in particular, were the largest import items. The United States imported about $335 million more in minerals than it exported to France; principal U.S. imports were among the iron and steel and radioactive materials. Coal, radioactive materials, copper, aluminum, nickel, phosphates, and diamonds were the principal commodities the United States exports to France.

Table 2.—France: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite	19,976	17,437	Sweden 6,141; Switzerland 5,974.
Oxide and hydroxide	353,919	326,438	Netherlands 135,703; Spain 47,439; Italy 35,730.
Metal including alloys:			
Scrap	32,094	33,967	Italy 15,247; West Germany 12,263; Belgium-Luxembourg 4,227.
Unwrought	165,792	166,418	Belgium-Luxembourg 37,711; West Germany 35,509; Italy 35,120.
Semimanufactures	191,045	217,291	West Germany 54,477; Belgium-Luxembourg 16,083; Italy 13,055.
Antimony:			
Ore and concentrate	1	7	NA.
Metal including alloys, all forms	219	392	Netherlands 181; Italy 43; Belgium-Luxembourg 40.
Arsenic:			
Anhydride and acid	7,231	--	
Metal including alloys, all forms	378	146	NA.
Beryllium metal including alloys, all forms value, thousands	$4	$41	NA.
Bismuth metal including alloys, all forms	72	7	NA.
Cadmium metal including alloys, all forms	132	219	Belgium-Luxembourg 120; United States 63.
Chromium:			
Chromite	982	983	Italy 808.
Oxide and hydroxide	284	171	United Kingdom 41; Switzerland 37.
Metal including alloys, all forms	455	611	United States 266; West Germany 127; Sweden 70.
Cobalt:			
Oxide and hydroxide	209	192	West Germany 68; Italy 41; United Kingdom 30.
Metal including alloys, all forms	1,066	1,100	West Germany 251; United States 238; United Kingdom 126.
Columbium and tantalum:			
Ores and concentrates[2]	10	--	
Metals including alloys, all forms:			
Columbium value, thousands	$12	$14	NA.
Tantalum do.	$656	$440	NA.
Copper:			
Ore and concentrate	2,309	(3)	NA.
Matte	1,390	504	Italy 198; Belgium-Luxembourg 185; West Germany 100.
Copper sulfate	10,111	11,245	West Germany 4,597; Netherlands 1,316; Italy 1,097.
Metal including alloys:			
Scrap	96,091	35,241	West Germany 24,664; Belgium-Luxembourg 3,666; Italy 2,174.
Unwrought:			
Blister and other unrefined	5,076	3,665	Belgium-Luxembourg 3,224; West Germany 347.
Refined	12,486	21,249	Italy 7,655; Belgium-Luxembourg 4,392; West Germany 3,865.
Masteralloys	150	342	West Germany 130; Italy 77; Spain 43.
Semimanufactures	107,804	117,679	West Germany 37,491; Netherlands 7,707; Belgium-Luxembourg 6,306.
Gold:			
Ash and sweepings kilograms	221	10,566	Spain 8,049; Switzerland 241.
Metal, unworked or partly worked:			
Of domestic origin thousand troy ounces	86	593	Netherlands 147; Spain 129; West Germany 12.
Temporary imports do.	1,226	158	Netherlands 58; Algeria 51; Romania 12.
Iron and steel:			
Ore and concentrate thousand tons	12,122	11,371	Belgium-Luxembourg 9,849; West Germany 1,521.

See footnotes at end of table.

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Table 2.—France: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Iron and steel —Continued			
Metal:			
Scrap thousand tons	3,357	3,662	Italy 3,067; Spain 266; West Germany 168.
Pig iron, cast iron, spiegeleisen do.	195	128	Belgium-Luxembourg 42; Italy 33; West Germany 14.
Sponge iron, powder and shot do.	35	36	West Germany 17; Italy 7; Spain 2.
Ferroalloys do.	460	501	United States 178; West Germany 104; Italy 86.
Steel, primary forms do.	2,135	2,200	Italy 701; United States 562; Greece 166.
Semimanufactures:			
Bars, rods, angles, shapes, sections do.	2,158	2,327	West Germany 363; Belgium-Luxembourg 247; United States 234.
Universals, plates, sheets do.	3,155	3,486	West Germany 624; United States 474; Italy 427.
Hoop and strip do.	406	449	West Germany 143; Belgium-Luxembourg 89; Italy 50.
Rails and accessories do.	261	231	Italy 64; Belgium-Luxembourg 28; United Kingdom 18.
Wire do.	130	154	United States 39; West Germany 36; Belgium-Luxembourg 11.
Tubes, pipes, fittings do.	1,272	1,366	U.S.S.R. 223; West Germany 112; Italy 58.
Castings and forgings, rough do.	59	60	Belgium-Luxembourg 19; West Germany 18; United Kingdom 4.
Lead:			
Ore and concentrate	29	40	NA.
Oxides	14,213	13,769	Romania 2,002; Czechoslovakia 1,602; Egypt 994.
Metal including alloys:			
Scrap	39,380	32,661	Italy 19,992; West Germany 9,908; Belgium-Luxembourg 2,328.
Unwrought	37,262	53,425	Belgium-Luxembourg 16,623; West Germany 13,713; Switzerland 5,981.
Semimanufactures	1,708	1,957	Belgium-Luxembourg 298; Netherlands 286; Italy 181.
Magnesium metal including alloys:			
Scrap	1,126	639	Netherlands 132; United States 81; Belgium-Luxembourg 61.
Unwrought	3,734	5,110	West Germany 2,727; Belgium-Luxembourg 431; Netherlands 375.
Semimanufactures	70	117	West Germany 60; Denmark 22; Spain 5.
Manganese:			
Ore and concentrate	8,323	5,606	Italy 2,571; Niger 1,201; Spain 554; Netherlands 330.
Oxides	2,863	3,660	Upper Volta 1,131; Madagascar 691; Ivory Coast 689.
Metal	1,945	2,138	Italy 861; West Germany 332; United States 172.
Mercury 76-pound flasks	1,218	3,539	Belgium-Luxembourg 1,915; Netherlands 696; United States 638.
Molybdenum:			
Ore and concentrate	162	336	Italy 181; United Kingdom 67; Austria 58.
Oxide	245	34	Netherlands 23.
Metal including alloys, all forms	93	136	West Germany 37; Netherlands 34; Belgium-Luxembourg 15.
Nickel:			
Matte, speiss, similar materials	211	850	Finland 716; West Germany 116.
Oxide and hydroxide	810	521	United States 85; Spain 76; Belgium-Luxembourg 67.
Metal including alloys:			
Scrap	2,429	306	West Germany 139; United Kingdom 83; United States 35.
Unwrought	4,989	5,324	West Germany 2,975; Italy 338; Mexico 329.
Semimanufactures	7,293	6,838	West Germany 2,186; United States 631; Italy 145.
Platinum-group metals:			
Waste and sweepings kilograms	142	3,150	United Kingdom 2,564; Spain 336.
Metals including alloys, all forms thousand troy ounces	297	245	Spain 125; Netherlands 47; United Kingdom 10.
Selenium, elemental	3	3	NA.
Silver:			
Waste and sweepings thousand troy ounces	9,239	9,908	Sweden 6,977; Spain 1,157; Belgium-Luxembourg 881.
Metal including alloys do.	29,573	14,860	United Kingdom 10,377; West Germany 2,030; Netherlands 2,006.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Thorium: Thoria and other compounds	393	448	Hong Kong 295; Canada 48; United Kingdom 48.
Tin:			
Ore and concentrate	18	10	NA.
Oxides	33	--	
Metal including alloys:			
Scrap	753	717	Netherlands 472; United Kingdom 216; West Germany 29.
Unwrought	423	868	United Kingdom 340; Netherlands 330; Italy 128.
Semimanufactures	347	598	Netherlands 150; West Germany 79; Italy 52.
Titanium:			
Ore and concentrate	370	331	Algeria 216.
Oxide	13,484	13,336	West Germany 2,678; United States 1,903; Belgium-Luxembourg 976.
Metal including alloys, all forms	636	530	Italy 172; United Kingdom 149; United States 67.
Tungsten:			
Ore and concentrate	1,125	1,613	West Germany 730; United States 626; Netherlands 168.
Oxide	27	2	NA.
Metal including alloys, all forms	338	297	United States 88; West Germany 61; Belgium-Luxembourg 45.
Uranium metal including alloys, all forms	10,177	11,785	United States 5,818; U.S.S.R. 4,250; United Kingdom 658.
Zinc:			
Ore and concentrate	24,174	54,588	Italy 27,887; Belgium-Luxembourg 26,698.
Matte	2,246	2,178	West Germany 976; Belgium-Luxembourg 477; Netherlands 357.
Metal including alloys, all forms:			
Scrap	2,385	1,786	Belgium-Luxembourg 759; Italy 520; West Germany 365.
Blue powder	2,684	1,648	United States 972; Switzerland 200; West Germany 151.
Unwrought	42,882	56,230	United States 24,347; West Germany 9,407; Italy 4,035.
Semimanufactures	30,536	42,515	Belgium-Luxembourg 19,001; West Germany 14,898; Denmark 3,013.
Zirconium:			
Ore and concentrate	1,086	742	Italy 641.
Oxide[4]	266	--	
Metal including alloys, all forms	398	584	United States 351; West Germany 90; Sweden 64.
Other:			
Ores and concentrates	21	107	NA.
Ash and residue containing nonferrous metals:			
Aluminum	10,146	9,227	Italy 6,585; West Germany 2,141.
Copper	17,988	20,292	Sweden 11,018; Spain 3,010; Belgium-Luxembourg 2,951.
Lead	5,046	3,807	Belgium-Luxembourg 1,856; West Germany 1,278.
Nickel	1,032	1,313	West Germany 410; Italy 369; Netherlands 365.
Zinc	20,429	46,795	Belgium-Luxembourg 34,462; Sweden 8,079; West Germany 2,504.
Unspecified	16,572	7,404	West Germany 2,472; Belgium-Luxembourg 1,525; Italy 1,100.
Oxides, hydroxides, peroxides of metals	3,473	4,771	United States 2,145; West Germany 1,275; East Germany 401.
Metals including alloys, all forms	478	554	Yugoslavia 165; West Germany 146; Belgium-Luxembourg 75.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc.	1,667	1,092	West Germany 480.
Dust and powder of precious and semiprecious stones value, thousands	$574	$737	Switzerland $439; Belgium-Luxembourg $175; United States $70.
Grinding and polishing wheels and stones	4,243	4,326	West Germany 930; Romania 475; Belgium-Luxembourg 352.
Asbestos	1,647	532	Tunisia 242.
Barite and witherite	99,358	116,535	West Germany 73,165; Netherlands 21,651; United States 6,600.
Boron materials:			
Crude natural borates	2,823	2,943	Belgium-Luxembourg 2,408.
Oxide and acid	29,548	30,057	West Germany 9,810; United Kingdom 5,442; East Germany 4,210.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Cement thousand tons	2,464	3,365	Ivory Coast 582; Cameroon 310; Venezuela 309.
Chalk	483,529	493,467	West Germany 197,024; Belgium-Luxembourg 93,363; Netherlands 51,381.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	10,073	10,371	Nigeria 3,274; Cameroon 1,020; Congo 499.
Kaolin, including calcined	120,996	121,325	West Germany 61,462; Italy 25,542; Switzerland 8,430.
Kyanite and sillimanite	5,881	2,090	West Germany 1,788.
Other	520,486	499,846	Italy 250,337; West Germany 121,179; Belgium-Luxembourg 24,004.
Products:			
Refractory (including nonclay brick)	131,356	150,794	West Germany 38,467; Belgium-Luxembourg 11,737; Italy 11,024.
Nonrefractory	322,304	272,109	West Germany 148,403; Belgium-Luxembourg 96,098; Switzerland 18,252.
Cryolite and chiolite	2	41	NA.
Diamond:			
Gem, not set or strung value, thousands	$19,922	$29,235	Switzerland $13,214; Belgium-Luxembourg $5,774; Netherlands $4,850.
Industrial do	$410	$1,193	Ireland $521; Belgium-Luxembourg $388; United States $82.
Diatomite and other infusorial earth	19,363	24,982	West Germany 8,755; Belgium-Luxembourg 4,771; Italy 1,684.
Feldspar	43,640	52,453	Belgium-Luxembourg 27,624; Spain 11,132; West Germany 6,545.
Fertilizer materials:			
Crude:			
Nitrogenous	101	1	NA.
Phosphatic	10,085	16,503	United Kingdom 10,489; Italy 2,316; Belgium-Luxembourg 1,859.
Potassic	12,420	11,533	Belgium-Luxembourg 10,126.
Other	24,712	23,452	Switzerland 13,701; Belgium-Luxembourg 3,761; Spain 2,479.
Manufactured:			
Nitrogenous thousand tons	428	570	Belgium-Luxembourg 125; China, mainland, 113; West Germany 88.
Phosphatic:			
Basic slag do	188	161	Switzerland 91; Austria 35; Italy 31.
Other do	29	21	Spain 5; Czechoslovakia 3; United Kingdom 3.
Potassic do	634	523	Belgium-Luxembourg 152; West Germany 83; Italy 76.
Ammonia do	141	72	West Germany 39; Spain 12; Greece 6.
Fluorspar	93,343	95,284	West Germany 63,258; Sweden 7,100; Belgium-Luxembourg 6,555.
Graphite	662	1,051	West Germany 486; U.S.S.R. 143; Spain 112.
Gypsum and plasters thousand tons	1,112	1,009	Belgium-Luxembourg 478; West Germany 176; Netherlands 130.
Iodine	31	97	United Kingdom 51; West Germany 17.
Lime	272,603	271,083	Belgium-Luxembourg 146,633; West Germany 91,792.
Magnesite	551	8,185	U.S.S.R. 1,500; Italy 1,160; West Germany 1,047.
Mica:			
Crude, including splittings and waste	2,940	3,120	United Kingdom 962; West Germany 541; Belgium-Luxembourg 388.
Worked, including agglomerated splittings	482	896	Switzerland 390; West Germany 175; Italy 86.
Pigments, mineral:			
Natural, crude	3,183	--	
Iron oxides, processed	4,484	9,521	Italy 1,109; Netherlands 1,073; United States 1,029.
Precious and semiprecious stones, except diamond value, thousands	$27,996	$30,903	Switzerland $22,720; United States $1,470; United Kingdom $894.
Pyrite, gross weight	33	87	NA.
Salt and brines	197,195	167,728	West Germany 129,200; Belgium-Luxembourg 26,578.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	46,068	52,564	Tunisia 5,894; West Germany 3,653; Republic of South Africa 3,134.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Sodium and potassium compounds, n.e.s. —Continued			
Caustic potash and sodic and potassic peroxides	14,844	5,348	United Kingdom 1,218; Republic of South Africa 1,163; Brazil 425.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	19,852	17,996	Switzerland 4,240; West Germany 4,143; Italy 3,095.
Slate	43,510	51,926	Netherlands 29,154; West Germany 10,557; Belgium-Luxembourg 7,989.
Other	75,620	58,808	Belgium-Luxembourg 42,996; West Germany 4,652; Switzerland 4,174.
Worked:			
Slate	4,987	5,105	Belgium-Luxembourg 2,167; West Germany 1,764; Netherlands 624.
Paving stone and flagstone	5,348	7,443	Belgium-Luxembourg 5,238; West Germany 1,031; Switzerland 827.
Other	26,289	30,938	Belgium-Luxembourg 12,362; West Germany 9,166; Saudi Arabia 1,556.
Dolomite, chiefly refractory grade	36,644	51,755	Belgium-Luxembourg 12,398; West Germany 11,838; Ivory Coast 5,449.
Gravel and crushed rock thousand tons	11,059	10,624	West Germany 7,909; Switzerland 1,079; Belgium-Luxembourg 824.
Limestone, except dimension	103,498	157,068	West Germany 126,796; Belgium-Luxembourg 27,775.
Quartz and quartzite	5,818	2,308	West Germany 296; United Kingdom 209.
Sand, excluding metal bearing thousand tons	4,007	4,342	West Germany 2,508; Switzerland 792; Italy 748.
Sulfur:			
Elemental, all forms do	948	1,159	United Kingdom 312; Netherlands 168; Italy 116.
Sulfur dioxide	1,754	--	
Sulfuric acid	134,110	139,057	Belgium-Luxembourg 65,071; Spain 36,249; West Germany 20,583.
Talc, steatite, soapstone, pyrophyllite	73,578	77,310	West Germany 24,323; United Kingdom 11,300; Spain 9,788.
Other:			
Crude:			
Meerschaum, amber, jet	1	--	
Other thousand tons	710	1,255	Belgium-Luxembourg 1,051; Switzerland 191.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture do	1,854	2,383	Belgium-Luxembourg 1,069; West Germany 872; Italy 359.
Slag and ash, n.e.s	192,099	253,859	West Germany 239,949; Switzerland 7,999.
Oxides and hydroxides of magnesium, strontium, barium	13,570	4,978	United States 3,209; West Germany 790.
Fluorine	22	1	NA.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	130,168	126,366	West Germany 22,597; Belgium-Luxembourg 16,989.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	60,032	10,379	United Kingdom 5,850; Spain 161.
Carbon black and gas carbon:			
Carbon black	52,368	56,246	West Germany 15,912; Italy 12,687; Spain 10,555.
Gas carbon	39	--	
Coal, including briquets:			
Anthracite and bituminous coal	586,847	531,749	Belgium-Luxembourg 110,950; United Kingdom 33,270; Italy 19,794.
Briquets of anthracite and bituminous coal	45,034	27,786	United Kingdom 24,919; Switzerland 1,862.
Lignite and lignite briquets	12,781	6,370	All to Spain.
Coke and semicoke thousand tons	838	766	Canada 179; Belgium-Luxembourg 155; Italy 73.
Gas, natural thousand cubic feet	6,273	6,250	Switzerland 3,207; Belgium-Luxembourg 2,921.
Hydrogen, helium, rare gases	1,049	3,469	Italy 2,437; Belgium-Luxembourg 339; Switzerland 102.
Peat, including peat briquets	2,216	2,075	Switzerland 1,013; United Arab Emirates 432.
Petroleum:			
Crude thousand 42-gallon barrels	1,512	194	Mainly to West Germany.

See footnotes at end of table.

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Table 2.—France: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum —Continued			
Refinery products:			
Gasoline[5] thousand 42-gallon barrels	21,650	21,970	Netherlands 6,045; West Germany 5,773; Switzerland 4,077.
Kerosine do	6,037	7,545	Switzerland 2,551; Denmark 1,084; Greece 472.
Distillate fuel oil do	30,592	35,430	West Germany 14,114; Switzerland 12,388; Italy 1,171.
Residual fuel oil do	35,306	26,557	Switzerland 5,125; United States 5,111; Italy 4,529.
Lubricants do	4,041	4,337	Belgium-Luxembourg 832; West Germany 585; United Kingdom 566.
Mineral jelly and wax do	395	738	United Kingdom 410; West Germany 152; Netherlands 49.
Liquefied petroleum gas do	8,459	6,256	Spain 3,208; West Germany 956; Morocco 706.
Other[6] do	2,740	3,219	West Germany 1,148; Switzerland 898; Belgium-Luxembourg 416.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	227,201	194,478	West Germany 116,776; Netherlands 29,658; United Kingdom 20,019.

NA Not available.

[1] Values are based on exchange rates of 4.9134 francs per U.S. dollar in 1977 and 4.5128 francs per U.S. dollar in 1978.

[2] Includes vanadium.

[3] Value only reported at $6,000, compared with $503,000 in 1977.

[4] Includes oxides of germanium.

[5] Includes motor and aviation gasoline, other light oils for similar uses, and white spirit.

[6] Includes pitch, pitch coke, petroleum coke, bitumen and other residues, and bituminous mixtures.

Table 3.—France; Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite thousand tons	1,920	1,955	Guinea 1,764; Greece 91; Guyana 55.
Oxide and hydroxide	35,695	60,733	West Germany 26,472; Guinea 15,962; Netherlands 6,315.
Metal including alloys:			
Scrap	37,081	42,289	West Germany 15,346; Belgium-Luxembourg 11,788; Netherlands 8,295.
Unwrought	275,266	290,827	Netherlands 69,064; West Germany 63,675; U.S.S.R. 29,723.
Semimanufactures	147,970	153,508	West Germany 58,976; Belgium-Luxembourg 40,898; Italy 12,732.
Antimony:			
Ore and concentrate	7,679	9,984	Bolivia 3,907; Thailand 2,613; Australia 1,238.
Metal including alloys, all forms	451	818	China, mainland, 601; Spain 129.
Arsenic metal including alloys, all forms	89	60	United States 30; Sweden 19.
Beryllium metal including alloys, all forms value, thousands	$761	$757	Mainly from United States.
Bismuth metal including alloys, all forms	644	346	Bolivia 132; Belgium-Luxembourg 55; United Kingdom 42.
Cadmium metal including alloys, all forms	625	609	Belgium-Luxembourg 185; Mexico 98; Netherlands 97.
Chromium:			
Chromite	281,006	242,480	Madagascar 77,511: Republic of South Africa 57,022; Turkey 41,554.
Oxide and hydroxide	5,579	5,241	West Germany 2,356; Italy 1,263; United Kingdom 930.
Metal including alloys, all forms	56	64	Japan 35; United Kingdom 19.
Cobalt:			
Intermediate metallurgical products	8,678	9,727	Mainly from Morocco.
Oxide and hydroxide	169	293	Belgium-Luxembourg 258; United States 20.
Metal including alloys, all forms	660	994	Belgium-Luxembourg 469; Zaire 179; United Kingdom 75.
Columbium and tantalum:			
Ores and concentrates[3]	11	([3])	NA.

See footnotes at end of table.

Table 3.—France: Imports of mineral commodities [1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Columbium and tantalum —Continued			
Metals including alloys, all forms:			
Columbium value, thousands	$65	$295	NA.
Tantalum	18	30	United States 14; West Germany 7.
Copper:			
Ore and concentrate	1,008	1	NA.
Matte	544	522	West Germany 464; United Kingdom 58.
Copper sulfate	2,527	2,540	Italy 778; U.S.S.R. 548; Belgium-Luxembourg 462.
Metal including alloys:			
Scrap	15,450	3,941	West Germany 901; Belgium-Luxembourg 684; United Kingdom 414.
Unwrought:			
Blister and other unrefined	33,733	22,734	Zaire 10,321; Republic of South Africa 5,390; Belgium-Luxembourg 2,803.
Refined	309,186	282,691	Belgium-Luxembourg 103,069; Zambia 56,024; Chile 28,082.
Masteralloys	430	789	Belgium-Luxembourg 118; West Germany 79; Spain 58.
Semimanufactures	204,481	213,502	Belgium-Luxembourg 125,048; West Germany 34,545; Italy 22,032.
Germanium metal including alloys, all forms value, thousands	$557	$795	Belgium-Luxembourg $346; United States $257.
Gold:			
Ash and sweepings kilograms	6,958	9,074	Switzerland 335; United Kingdom 163; Spain 67.
Metal, unworked or partly worked:			
For domestic use thousand troy ounces	1,271	1,666	West Germany 1,428; Netherlands 180.
Temporary imports do	1,219	629	Republic of South Africa 372; Switzerland 126; Netherlands 81.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	15,432	14,604	Brazil 4,301; Australia 2,197; Mauritania 2,140.
Roasted pyrite	78,187	92,272	Italy 63,639; West Germany 15,275; Spain 13,334.
Metal:			
Scrap	287,030	393,803	Belgium-Luxembourg 178,370; West Germany 91,612.
Pig iron, cast iron, spiegeleisen[4] thousand tons	460	407	West Germany 366; Canada 19.
Sponge iron, powder, shot	28,306	19,335	Sweden 11,081; West Germany 2,663; Spain 2,571.
Ferroalloys thousand tons	190	179	New Caledonia 54; Republic of South Africa 17; Belgium-Luxembourg 16.
Steel, primary forms do	1,886	2,272	Belgium-Luxembourg 1,211; West Germany 649; Italy 127.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	2,097	1,871	Italy 368; West Germany 290; Belgium-Luxembourg 273.
Universals, plates, sheets do	2,616	2,575	Belgium-Luxembourg 1,198; West Germany 636; Italy 195.
Hoop and strip do	320	322	Belgium-Luxembourg 160; West Germany 112; Italy 9.
Rails and accessories	23,066	36,360	Belgium-Luxembourg 20,785; United Kingdom 12,919.
Wire thousand tons	102	117	Belgium-Luxembourg 46; West Germany 34; Italy 16.
Tubes, pipes, fittings do	458	487	Italy 147; West Germany 143; Spain 57.
Castings and forgings, rough	43,022	43,191	West Germany 21,299; Italy 8,454; Belgium-Luxembourg 4,326.
Lead:			
Ore and concentrate	125,561	134,738	Australia 33,891; Morocco 29,858; Ireland 29,732.
Oxides	1,409	841	Belgium-Luxembourg 491; West Germany 166.
Metal including alloys:			
Scrap	11,262	17,246	Belgium-Luxembourg 12,418; Netherlands 2,509; United Kingdom 881.
Unwrought	47,631	38,238	West Germany 13,375; Belgium-Luxembourg 12,787; United Kingdom 9,747.
Semimanufactures	709	1,234	West Germany 512; Belgium-Luxembourg 318.
Magnesium metal including alloys:			
Scrap	158	257	Italy 154.

See footnotes at end of table.

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Table 3.—France: Imports of mineral commodities [1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Magnesium metal including alloys —Continued			
Unwrought	3,043	3,149	Norway 1,933; U.S.S.R. 440; United States 390.
Semimanufactures	130	357	Italy 166; West Germany 129.
Manganese:			
Ore and concentrate thousand tons	923	958	Republic of South Africa 395; Gabon 334; Brazil 131.
Oxides	7,074	5,541	Spain 1,840; West Germany 1,177; Belgium-Luxembourg 1,160.
Metal	1,121	1,030	Republic of South Africa 561; Japan 294; Netherlands 172.
Mercury 76-pound flasks	6,150	5,279	Italy 2,205; Spain 2,002; Algeria 754.
Molybdenum:			
Ore and concentrate	7,314	6,963	United States 2,822; Canada 2,167; Netherlands 779.
Oxide	55	359	West Germany 205; Netherlands 67; Sweden 57.
Metal including alloys, all forms	185	164	United States 61; Austria 53; Netherlands 15.
Nickel:			
Ore and concentrate	966	100	NA.
Matte, speiss, similar materials	20,427	12,986	New Caledonia 10,230; Canada 1,000; Australia 823.
Oxide and hydroxide	177	226	Canada 154; Cuba 61.
Metal including alloys:			
Scrap	1,340	74	Spain 40.
Unwrought	12,137	12,177	Republic of South Africa 3,850; United Kingdom 2,113; Canada 1,441.
Semimanufactures	6,720	5,560	United Kingdom 1,966; West Germany 1,369; United States 1,049.
Platinum-group metals:			
Waste and sweepings kilograms	3,198	2,578	Netherlands 581; Spain 413; West Germany 272.
Metals including alloys, all forms troy ounces	422,139	358,512	United Kingdom 134,872; Switzerland 52,599; U.S.S.R. 38,677.
Selenium, elemental	50	53	Japan 23; United Kingdom 10; Belgium-Luxembourg 8.
Silver:			
Waste and sweepings kilograms	48,779	192,624	United Kingdom 115,391; Switzerland 18,431; United States 14,470.
Metal including alloys thousand troy ounces	49,703	43,498	United Kingdom 16,495; India 7,424; Belgium-Luxembourg 3,437.
Thorium, ore and concentrate	6,531	9,053	Australia 6,811; United States 2,115; Zaire 65.
Tin:			
Oxides	220	--	
Metal including alloys:			
Scrap	268	136	Italy 96; Switzerland 25; Belgium-Luxembourg 10.
Unwrought	10,509	10,828	Malaysia 3,434; Indonesia 2,090; Thailand 1,784.
Semimanufactures	412	388	Italy 145; West Germany 76; Netherlands 45.
Titanium:			
Ore and concentrate	144,127	154,477	Australia 152,990.
Oxides	23,512	27,190	West Germany 8,780; Belgium-Luxembourg 5,661; Netherlands 4,112.
Metal including alloys, all forms	1,025	965	United Kingdom 279; United States 227; Japan 161.
Tungsten:			
Ore and concentrate	2,034	2,468	Thailand 569; China, mainland, 329; Canada 285.
Oxide	53	34	Mainly from West Germany.
Metal including alloys, all forms	173	251	West Germany 22; Netherlands 18; Denmark 17.
Uranium:			
Ore and concentrate	3,436	3,131	Gabon 1,426; Niger 1,294.
Metal including alloys, all forms	5,686	5,394	Republic of South Africa 2,016; U.S.S.R. 1,015; Belgium-Luxembourg 623.
Zinc:			
Ore and concentrate	466,580	454,582	Canada 113,364; Peru 105,783; Ireland 72,615.
Oxide	4,229	5,062	West Germany 1,519; Belgium-Luxembourg 1,118; Italy 923.
Metal including alloys, all forms:			
Scrap	7,997	8,028	Netherlands 2,750; Belgium-Luxembourg 2,022; West Germany 1,121.
Blue powder	2,597	3,456	Belgium-Luxembourg 2,687; Netherlands 367; Spain 192.

See footnotes at end of table.

Table 3.—France: Imports of mineral commodities [1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Zinc —Continued			
Metal including alloys, all forms —Continued			
Unwrought	86,135	99,732	Belgium-Luxembourg 49,387; Netherlands 16,592; West Germany 7,774.
Semimanufactures	4,902	5,526	West Germany 3,274; Belgium-Luxembourg 944; Poland 523.
Zirconium:			
Ore and concentrate	31,549	38,787	Australia 36,044; West Germany 1,521.
Oxide[4]	714	719	United States 386; United Kingdom 269.
Metal including alloys, all forms	149	496	United States 392; United Kingdom 41.
Other:			
Ores and concentrates	3,543	1,662	NA.
Ash and residue containing nonferrous metals:			
Aluminum	5,396	7,138	Italy 3,039; Netherlands 1,515; West Germany 1,485.
Copper	1,079	1,072	Japan 690.
Lead	13,074	9,712	Italy 7,927; Belgium-Luxembourg 1,283.
Nickel	44	40	NA.
Zinc	15,690	22,750	Belgium-Luxembourg 10,521; West Germany 6,605; Netherlands 2,447.
Other	11,303	15,182	Italy 13,682; Switzerland 992.
Oxides, hydroxides, peroxides of metals	2,065	2,739	West Germany 709; Finland 478; Belgium-Luxembourg 395.
Metals including alloys, all forms	327	466	U.S.S.R. 101; Austria 21; West Germany 20.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc.	40,568	38,097	Turkey 26,098; West Germany 4,001; Italy 1,803.
Dust and powder of precious and semiprecious stones value, thousands	$10,757	$10,862	United States $5,579; Republic of South Africa $2,792; Switzerland $835.
Grinding and polishing wheels and stones	7,469	7,231	Italy 1,913; West Germany 1,603; Belgium-Luxembourg 1,417.
Asbestos	114,790	110,812	Canada 43,185; U.S.S.R. 38,028; Netherlands 8,455.
Barite and witherite	11,814	8,983	West Germany 8,226.
Boron materials:			
Crude natural borates	171,178	181,070	Turkey 115,881; United States 62,365.
Oxide and acid	1,087	8,878	United States 3,666; West Germany 2,577.
Bromine	1,970	2,762	Israel 2,079; United Kingdom 607.
Cement	152,028	313,725	Belgium-Luxembourg 265,795; Italy 17,454.
Chalk	23,868	35,689	West Germany 29,577; Belgium-Luxembourg 6,011.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	90,482	87,235	Italy 30,295; Greece 27,991; West Germany 11,943.
Kaolin, including calcined	322,324	306,755	United Kingdom 228,663; United States 25,141.
Kyanite and sillimanite	4,850	6,196	India 2,705; United States 1,751; United Kingdom 904.
Other	226,859	200,398	West Germany 146,814; United Kingdom 24,036; United States 15,900.
Products:			
Refractory (including nonclay brick)	149,811	130,947	West Germany 51,888; Austria 28,721; Belgium-Luxembourg 22,302.
Nonrefractory thousand tons	730	114	Italy 36; West Germany 21; Spain 19.
Cryolite and chiolite	1,080	792	Denmark 744.
Diamond:			
Gem, not set or strung value, thousands	$161,634	$275,192	Belgium-Luxembourg $113,735; Switzerland $57,855; Israel $37,894.
Industrial do.	$5,465	$7,210	Belgium-Luxembourg $2,147; Ireland $2,069; Central African Empire $770.
Diatomite and other infusorial earth	5,254	8,878	United States 3,666; West Germany 2,577; Algeria 996.
Feldspar	17,323	17,024	West Germany 11,195; Spain 4,819.
Fertilizer materials:			
Crude:			
Nitrogenous	6,575	9,220	All from Chile.
Phosphatic thousand tons	4,736	4,966	Morocco 2,054; United States 1,048; Tunisia 361.
Other	35,983	23,098	Netherlands 11,382; Italy 4,391; Belgium-Luxembourg 2,906.

See footnotes at end of table.

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Table 3.—France: Imports of mineral commodities [1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Fertilizer materials —Continued			
Manufactured:			
Nitrogenous ...... thousand tons..	937	1,105	Belgium-Luxembourg 464; Netherlands 341; West Germany 62.
Phosphatic:			
Basic slag ....do....	330	498	Belgium-Luxembourg 488; West Germany 10.
Other ....do....	526	600	United States 160; Tunisia 124; Netherlands 86.
Potassic..............do....	495	322	Belgium-Luxembourg 135; Israel 56; U.S.S.R. 41.
Ammonia ....do....	254	284	Belgium-Luxembourg 84; Netherlands 55; West Germany 43.
Fluorspar	14,845	1,796	United Kingdom 769.
Graphite, natural	5,727	6,781	Italy 1,726; Madagascar 1,425; West Germany 1,137.
Gypsum and plasters ..... thousand tons..	14,011	16,900	Spain 8,606; West Germany 5,215.
Iodine	745	998	Japan 665; Chile 298.
Lime	98,964	86,870	West Germany 42,011; Belgium-Luxembourg 40,259.
Magnesite	80,903	92,239	Greece 29,356; Spain 10,332; Italy 7,654.
Mica:			
Crude, including splittings and waste	3,614	10,164	India 7,424; Brazil 1,355; United States 386.
Worked, including agglomerated splittings	160	224	Belgium-Luxembourg 79; Switzerland 76; West Germany 27.
Pigments, mineral:			
Natural, crude	1,169	--	
Iron oxides, processed	28,960	28,867	West Germany 21,387, Belgium-Luxembourg 5,740.
Precious and semiprecious stones, except diamond ..... value, thousands..	$58,690	$99,671	Switzerland $58,865; India $10,950; Thailand $6,978.
Pyrite, gross weight	601	617	Italy 466; West Germany 117.
Salt and brines	156,397	162,782	Belgium-Luxembourg 95,262; Netherlands 36,185; West Germany 19,036.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	106,412	136,476	Belgium-Luxembourg 49,238; West Germany 43,124; Italy 23,012.
Caustic potash and sodic and potassic peroxides	474	899	Yugoslavia 325; West Germany 230.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	68,957	87,136	Italy 38,662; West Germany 38,218; Portugal 5,057.
Slate	8,185	6,319	United Kingdom 2,749; Spain 1,776; Italy 1,506.
Other	175,725	161,535	Republic of South Africa 58,155; Norway 35,103; Finland 21,122.
Worked:			
Slate	117,676	127,175	Spain 124,209; Italy 1,509.
Paving stone and flagstone	53,250	33,014	West Germany 19,015; Italy 12,587.
Other	104,913	104,796	Italy 91,588; West Germany 3,006; Belgium-Luxembourg 1,367.
Dolomite, chiefly refractory grade	345,567	296,808	Belgium-Luxembourg 181,607; West Germany 94,187.
Gravel and crushed rock thousand tons..	5,713	4,697	Belgium-Luxembourg 3,490; United Kingdom 827; Norway 123.
Limestone, except dimension	224,330	188,303	Belgium-Luxembourg 186,864.
Quartz and quartzite	14,647	13,941	Italy 8,208; Portugal 2,492; West Germany 1,139.
Sand, excluding metal bearing thousand tons..	1,441	1,231	Belgium-Luxembourg 712; United Kingdom 344; Netherlands 151.
Sulfur:			
Elemental, all forms	652,222	663,716	Poland 446,868; United States 89,066; Canada 88,237.
Sulfur dioxide	735	--	
Sulfuric acid	179,608	200,272	Belgium-Luxembourg 102,724; West Germany 91,419.
Talc, steatite, soapstone, pyrophyllite	12,147	17,258	Italy 10,886; Belgium-Luxembourg 2,341; Norway 1,402.
Other:			
Crude .... thousand tons..	897	978	Switzerland 597; Spain 185; West Germany 85.

See footnotes at end of table.

Table 3.—France: Imports of mineral commodities [1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Other —Continued			
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture thousand tons	1,051	834	Belgium-Luxembourg 509; West Germany 196; Canada 83.
Slag and ash, n.e.s	89,945	68,444	West Germany 59,065; Netherlands 2,223.
Oxides and hydroxides of magnesium, strontium, barium	3,488	1,416	West Germany 649; Ireland 152; Japan 108.
Bromine and fluorine	1,974	2,767	Israel 2,079; United Kingdom 607.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	135,503	149,551	Italy 50,119; Belgium-Luxembourg 39,830; West Germany 25,270.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,202	2,246	United States 1,421.
Carbon black and gas carbon:			
Carbon black	78,073	76,566	Netherlands 35,014; West Germany 23,620; Italy 8,220.
Gas carbon	21	--	
Coal, including briquets:			
Anthracite and bituminous coal thousand tons	21,522	23,783	Republic of South Africa 6,921; West Germany 6,446; Poland 4,882.
Briquets of anthracite and bituminous coal do	74	268	West Germany 239; Belgium-Luxembourg 22.
Lignite and lignite briquets do	169	175	West Germany 174.
Coke and semicoke do	2,189	1,696	West Germany 1,462; Netherlands 112; Belgium-Luxembourg 94.
Gas, natural million cubic feet	524	544	Netherlands 410; Algeria 82; Norway 52.
Hydrogen and rare gases	27,032	35,200	Belgium-Luxembourg 25,451; West Germany 4,147; Netherlands 2,595.
Peat, including peat briquets thousand tons	103	116	West Germany 64; U.S.S.R. 31; Netherlands 16.
Petroleum:			
Crude thousand 42-gallon barrels	874,875	1,321,015	Cameroon 460; Saudi Arabia 292; Iraq 150.
Refinery products:			
Gasoline[5] do	20,956	19,727	West Germany 5,245; Italy 4,293; U.S.S.R. 2,171.
Kerosine do	487	329	Italy 267; West Germany 12; Belgium-Luxembourg 7.
Distillate fuel oil do	20,863	25,649	U.S.S.R. 9,078; Italy 8,305; United Kingdom 3,147.
Residual fuel oil do	11,861	17,447	Netherlands 3,666; United Kingdom 3,598; Italy 2,685.
Lubricants do	632	739	United Kingdom 222; Italy 161; Netherlands 98.
Mineral jelly and wax do	139	141	West Germany 42; Netherlands 40; United States 19.
Liquefied petroleum gas do	3,059	3,646	United Kingdom 715; U.S.S.R. 682; Italy 352.
Other[6] do	6,491	9,827	United States 7,927; West Germany 658; United Kingdom 586.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	388,805	428,074	United States 237,190; Netherlands 76,788; Belgium-Luxembourg 38,884.

NA Not available.

[1] Values are based on exchange rates of 4.9134 francs per U.S. dollar in 1977 and 4.5128 francs per U.S. dollar in 1978.

[2] Includes vanadium.

[3] Less than 1/2 unit.

[4] Includes oxides of germanium.

[5] Includes motor and aviation gasoline, other light oils for similar uses, and white spirit.

[6] Includes pitch, pitch coke, petroleum coke, bitumen and other residues, and bituminous mixtures.

COMMODITY REVIEW

METALS

Aluminum.—During 1978 and 1979, production of bauxite in France was down because of declining reserves. By far the largest producer remained Aluminium Pechiney; its output accounted for about 70% of the total French bauxite output.

Three alumina plants, all owned by Pechiney-Ugine-Kuhlmann (PUK), were in operation in France. Total capacity was 1.3 million tons per year. The largest plant, at

Cardane (Bouches-du-Rhône), had a capacity of 750,000 tons per year.

During 1979, Aluminium Pechiney announced plans to increase its aluminum smelting capacity in France by 82,000 tons, to reach a total of 489,000 tons by 1983, at an estimated cost of $94 million. The largest increase was planned for the St. Jean de Maurienne installation, which will reach a capacity of 120,000 tons, or 55% more than the present.

Ten aluminum smelters were operational in 1978-79, all owned by PUK. The largest, located at Noguéres, had a capacity of 115,000 tons of aluminum per year. France was a net importer of bauxite and aluminum and a net exporter of alumina.

Packaging consumed 27% of total aluminum consumption in France; building construction followed with 18%.

Antimony.—BRGM accelerated exploration of antimony deposits at Quimper and d'Ouche (Cantal) during 1978 and 1979. Reserves at both deposits are small, and a large production was not to be expected.

There was no mine production of antimony, but the Société Nouvelle des Mines de la Lucette operated a smelter and a plant for production of antimony chemicals from Moroccan concentrates at Le Genest (Mayenne).

Copper.—Two copper deposits were being examined during 1978 and 1979 by the BRGM: At Porte-aux-Moins (Cote du Nord) and Bodennec (Finistére), which are faulted. Most French deposits, including these, are furthermore small and low grade (0.5% to 2.0% copper); lead and zinc are also usually present, and the separation of the metals presents a technical problem. Porte-aux-Moins and Bodennec are about 30 miles apart, and a single concentrator was being considered for the two of them.

France was completely dependent on imported raw materials and scrap for its largest copper smelter, the 45,000-ton-per-year plant at Palais, Haute Vienne, and two smaller ones with annual production of few hundred tons. France was also a net importer of copper metal. Annual consumption amounted to about 330,000 tons, of which about 57% was used by the electrical industry, 22% by the appliance industry, and 12% by the construction industry.

During 1979, additional finance was obtained for the copper plan initiated in 1972; during 7 years of its existence the plan had proved its effectiveness. Its aim was to develop new copper resources in French territory; to promote cooperation between France and developing mining countries; and to encourage greater use of copper scrap.

Gold.—Exploration for gold was conducted by the BRGM and Peñarroya in the region of Saint-Yrieix (Haute Vienne). Results were described as encouraging, but no details were made public.

The Salsigne mine (Aude), owned by Société des Mines et Produits Chimiques de Salsigne, produced gold from a complex ore also containing silver, copper, bismuth, and arsenic; matte was shipped abroad for recovery of the metals.

Iron and Steel.—The French Government's plan to save the steel industry and the related merger of Chiers-Chatillon with Usinor, the largest producer of steel in France (capacity 7.9 million tons per year), were the major events during the years of 1978 and 1979.

During 1978, the French iron and steel industry had a near disastrous year. All indicators were down, and the threat of bankruptcy became very real as losses of the industry became astronomic. After long, and sometimes heated, discussions, the French Assembly and Senate approved a steel plan that provided major financial relief for the largest French steel companies for 5 years; it also distributed the costs of recent losses and avoided the effects of bankruptcy on financial markets. Although the plan gave the Government direct and indirect majority control of the steel companies, it was described not as a nationalization but as a purely financial arrangement; restructuring of the companies and terms of employment remained the responsibility of the management. The Government stated its intention to eventually return control to the private sector; this, and repayment of the Government loans, will depend on how the individual firms restore profitability. The new steel plan will substantially alter the composition of shareholding in the steel companies affected.

At yearend 1978, proposals for restructuring the industry, still under discussion, included the following steps, among others, at Usinor: Concentration of steel and steel semimanufactured products in Dunkerque and closure by summer 1979 of the iron and steel furnaces at Denain; retention of the cold rolling facilities at Montataire, Mardyck, and Biache; closure of installations at Blagny but not the plant at d'Isbergues. The plant at Azin will be closed, and the rolling trains for long products at Longwy et de Neuve-Maisons will remain in operation. Construction of a steel plant at Neuves-Maisons will be completed. Facilities for continuous casting at Neuves-Maisons and at Thionville also will be completed. The Chiers-Longwy steel plant will be closed during 1979; the steel plant, operated by Usinor at Longwy, was slated to stop production at the end of 1980. All closures at Usinor will result in a loss of 12,000 jobs.

At Sacilor-Sollac, most of the efforts will be directed toward modernization. However, blast furnaces and the coking plant at Hagodange will be closed. Measures taken at Sacilor-Sollac would result in a loss of 8,500 jobs. At yearend, strong opposition to this plan was voiced by steelworkers who feared the possibility of losing eventually more than 20,000 jobs. Local authorities at Longwy, Denain, and Valencienne, communities hardest hit by the proposed plans, also expressed concern. Negotiations were underway to find solutions to help the steelworkers and the Lorraine economy.

In addition, on November 16, 1978, a merger was announced between Usinor and Chiers-Chatillon's fully owned subsidiary, La Societe Chatillon-Neuves-Maisons. After merging, streamlining of iron and steel facilities will be undertaken, and duplicate facilities and obsolete equipment should be eliminated.

During the early part of 1979, social unrest and strikes prevailed in steel-producing areas of France, and steelworkers also rioted in Paris. In July 1979, an agreement, apparently satisfactory to all, was signed guaranteeing social protection to workers of the steel industry affected by consolidation of the industry. According to the agreement, bonuses ranging between 10,000 and 50,000 francs were to be given to all those who voluntarily left the industry before July 1. Older workers were placed into two categories; those aged 55 to 65 were to be pensioned at 75% of their former salaries, and those aged 50 to 55, at 70%. the Government will cover most of these costs, and a small contribution will be made by professional organizations. Development of new industries and priority for employment of former steelworkers were also part of the contract.

Lead and Zinc.—Exploration of complex sulfide ores containing lead, zinc, copper, and some silver in the Massif Armoricain in Britanny continued. Results were mixed. At the Menex-Albot (Finistére), deposit results of the first exploratory drilling were reportedly encouraging. The Rouex (Sarthe), sulfide deposit of about 50 million tons, was reported to be too low grade to warrant exploitation. In addition, exploration for lead and zinc was carried out in Vosges where a discovery was recorded at Lusse. In the Pyrenees, reports indicated a discovery at Nerbiou (Hautes-Pyrénées). Both deposits require further exploration before any assessment of their value can be made.

Nickel.—Société Le Nickel SA (SLN) closed its nickel plant at Le Havre in July 1978 and replaced it with a new 16,000-ton-per-year nickel electrolytic plant at Sandouville which cost 250 million francs to build.

The Sandouville plant is located 15 kilometers from Le Havre between the Tancarville Channel and the Central Maritime Channel (Le Canal Central Maritime), on the grounds of an industrial park managed by Post Authority of Le Havre. There is a railroad connection and in the near future a connection with a nearby highway will be built. The new facility has an annual capacity of 16,000 tons of pure electrolytic nickel, with preliminary expected analysis as follows: Nickel, 99.7%; cobalt, less than 20 ppm; and iron, copper, and zinc, each less than 10 ppm. The raw material will be nickel matte (75% nickel) from New Caledonia.

In addition to nickel, the following byproducts will be produced: iron chloride (600 tons per year of contained iron); cobalt chloride (350 tons of contained cobalt); and sulfur (4,000 tons per year). Raw materials for nickel salt production will also be supplied to a plant operated by Selnic, a subsidiary of SLN. The plant will also be able to produce nickel oxide and powders. The hydrometallurgical process, developed in part in the SLN research center in Trappes, includes, (1) nickel matte treatment with chlorine, (2) extraction and purification of the liquid phase, (3) eletrolysis of nickel chloride, and (4) casting of cathodes. All effluents, solid, liquid, and gases, are controlled to eliminate possible pollution of the Seine basin. Employment is 265 persons.

The changeover from the Le Havre plant to the Sandouville plant and startup problems resulted in a significant drop in French nickel production in 1978, followed by a 6-month loss of production in 1979 due to a plant fire. Domestic annual consumption of nickel metal was around 33,200 tons.

The iron and steel industry used about 66.5% of the total. Semimanufactures, electroplating, and foundries used between 6% and 7% each; production of money and other medals, 3.1%; and catalysts, the electric industry, and the automobile industry used between 1% and 2% each.

Tungsten.—A pilot mine, operated by BRGM, started production at Montredon (Tarn), to test selective open pit methods. Reserves were reported at 1 million tons with an average content of 0.70% WO_3. Montredon is one of several tungsten deposits discovered in France by BRGM during the past several years.

In addition, during 1978 and in the beginning of 1979, two tungsten mines were in operation: the largest producer, the Salau Mine (Ariege), operated by Société Minière d'Anglade, and the smaller producer, Enguiales Mine (Aveyron), operated by Société Minière et Chimique du Chatelet. In March 1979 Enguiales Mine was closed because of financial problems. Leaching of concentrates was done at Gurugnon plant operated by CEA. Because of imminent closure of the plant at Gueugnon, leaching of tungsten concentrates was transferred to a plant at Séte, operated by Compagnie Française d'Azote. Although France was the largest producer of tungsten among the European Economic Community countries, imports of concentrates were necessary to meet the demand. France consumed about 1,700 tons of tungsten metal in 1978, of which 51% was used in steel production and 24%, in production of tungsten carbides.

NONMETALS

Barite.—France was an important producer and a net exporter of barite during 1978 and 1979. Production remained at the same order of magnitude as in 1977 and roughly half of the output was exported. Principal producers of barite were Société Barytine de Chaillac (Indre), Société de Mines de Carrot, and Société des Couleurs Zinciques. About 87% of the barite consumption of France was in drilling muds.

Cement.—Société des Ciments Francais, with 22 plants, and Ciments LaFarge France, with 18 plants, were the largest cement producers in France. Total national capacity was about 40 million tons of cement. Preliminary reports indicate that in 1979 the industry operated at about 65% of capacity. The French Government removed controls from cement prices during the year. After conversion of the Haubourdin and the Teil plants during 1979, all Lafarge clinker production was produced by dry process units except in Limay and Séte. At Haubourdin, conversion was accomplished by changing a long wet unit to a semi-dry with filters to produce filter cake for Polysiús Lepol preheating grate. At the white cement plant at Teil, conversion was made to the dry process with preheater and precalciner. This conversion resulted in a caloric consumption of 3.5 million Btu per ton instead of 4.1 million Btu in Lafarge.

Talc.—The only mine producer of talc in France, Talc de Luzenac (Ariége), completed construction of an aerial tramway connecting its opencast mine at Trumouns (elevation 1,800 meters above the sea level) to its plant at Luzenac (elevation 600 meters) during 1978. Reportedly the capacity of 190 tons per hour, on a difference of elevation of more than 1,000 meters, made the installation one of the world's largest aerial tramways; annual capacity should be between 442,000 tons and 574,000 tons.

MINERAL FUELS

Coal.—During 1978 and 1979, according to preliminary data, French coal output declined as a result of lack of demand due to the general economic situation. The following tabulation shows production of coal in France by kinds and regions, December and 12-month cumulative for 1978, in metric tons.

Kind of coal	Regions	December 1978	January-December 1978
Coal:			
Bituminous and anthracite.	Nord-Pas-de-Calais.	499,355	5,974,191
	Lorraine	725,498	9,763,572
	Centre Midi	271,316	3,952,517
Total		1,496,169	19,690,280
Lignite	Centre Midi	119,065	1,564,721
	Region Landaise	145,000	1,167,105
Total		264,065	2,731,826
Grand total		1,760,234	22,422,106

NA Not available.

Source: Coal International, Zinder Neris Inc., Washington, N. Y. A monthly inventory of information, V. 1, No. 1, May 1978.

French Government projections indicated French demand would increase by tenfold by the year 2000; as one step to meet the expected demand, the BRGM, during the year, acquired about 50% of the Wambo Mining Co. of Australia.

In January 1978, the French Government and the State-owned coal monopoly, Charbonnages de France (CdF), reached agreement on a new contractual basis for their relationship. The contract, which had been under discussion since 1974, covered the 3-year period beginning January 1, 1978, and aimed at reestablishing the financial profitability of CdF. In spite of large State payments, CdF lost 200 million francs on its coal operations in 1977. In order to bring these operations back to equilibrium, the French Government was to take the following actions:

(1) Assume the expenses not allocable to normal operations. These expenses include special retirement charges, costs from closed mines, and costs involved in retaining employees affected by staff reductions.

(2) Assume servicing costs of debt incurred to finance past losses and costs of research previously undertaken for the French Government.

(3) Provide a subsidy of 14 francs per kilotherm produced, up to the annual planned production (for a total of 1,875 million francs in 1978). The amount of the subsidy per kilotherm will be increased annually by the same percentage as the industrial price index.

(4) Grant additional compensation for any new demands placed on CdF by the State.

In return for these financial aids, CdF is expected to break even in its operating budget. In order to achieve this, CdF will be freed of the price controls it has been laboring under, and which it blames for its losses. Prices at the mine for industrial coal were expected to increase 8% by May 1978 and an additional 8% in July (prices to the consumer were to rise by 12%). Prices, at the mine, for domestic coal are expected to increase 8% in May and 30% in July (for a 19% increase to the consumer).

The contract calls for CdF's annual capital budget to be set by the Fonds de Development Economique et Social (FDES). The 1978 budget earlier had called for 895.4 million francs to be invested in the following manner:

	Million FF
Development of current mines	161.0
Social investments (housing, etc.)	138.3
Coal-based industries (cokeries, electrical generating)	314.4
New coal mine projects	194.0
New industrial projects	62.3
Exploration	5.4
Foreign participation	5.0
Other	15.0

All CdF obligations issued for these purposes will be guaranteed by by French Government.

While the redefinition of CdF's relationship with the State will not result in a great resurgence of the French coal industry, the commercial freedom from which CdF will benefit should allow it to develop its currently profitable coal mines more quickly. This may provide some limited opportunities for U.S. mining equipment sales. Coal imports (including those from the United States), which provide approximately half

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of French coal consumption, are not expected to be significantly affected.

Natural Gas.—Gas de France, the principal gas distributor in France, commissioned Ateliers et Chantiers de Bretagne (ACB) to design and manufacture a liquefied natural gas (LNG) vaporization plant for the future methane terminal at Montoir de Bretagne. The capacity of the new installation was reported to be 1,200 cubic meters of LNG per hour. Furthermore, France continued to build 80,000 cubic meters of additional underground storage space for natural gas in the area near Fos, a seaport in southern France. At yearend 1979, Gas de France was suffering financial difficulties caused by increases in costs of equipment. France remained dependent on imports of natural gas to meet about 70% of its demand. The Netherlands was the principal supplier of imported natural gas; the Lacq Region in southern France produced about 97% of domestic natural gas.

Petroleum.—During 1978 and 1979, France remained almost completely dependent on imports of crude petroleum to meet its demand. Roughly about 99% of crude oil processed in French refineries was imported. However, about three-quarters of oil imports came from foreign fields that were partly or completely operated by French interests.

Exploration and Production.—Exploration in France was small by number of rigs in operation (14) and number of basins (2) where it was conducted, and results were mixed. The Aquitaine Basin and Paris Basin were the chief theaters of exploration.

In Aquitaine, on one permit, granted to Comminges (Elf Aquitaine 70% and Essorep 30%), the work on evaluation of the Lannemazan gas deposit continued, but results were inconclusive. Drilling at the Bonnefont 1 well encountered oil at the depth of 3,720 meters. During a 9-hour drill steam test about 5 cubic meters of 0.85 density oil were recovered. At the d'Armagnac permit (Elf Aquitaine 50% and Shell Francaise 50%), oil in small quantities was found in formations similar to those at Grenade. At the Bezordan structure, production had to be stopped because of large intrusions of water. Water breakthrough happened after production of 15 million cubic meters of gas. This gas was processed in the gas plant at Boussens.

In the Paris Basin, step-out drilling was underway at the Soudron structure, but results were not made public at yearend.

The Paris and Aquitaine Basins were the only two producing basins during 1978. Aquitaine accounted for about 80% of the total with fields at Parentis, Cazaux, Mothes, Lavergne, Lacq, Superieur, and others; Esso contributed approximately 68% of the total production.

During 1979, discoveries in the southwest of France, near Burosse and Vialer, were promising and after development could produce 1 million tons of crude per year. This would almost double present French domestic output.

Refining.—In September 1978, Elf suspended operations at the 1.5-million-ton-per-year oil refinery at Vern-sur-Seiche (Ille-et-Vilaine). During the year, French refineries operated at 69% of the installed capacity. At yearend 1979, there were 22 refineries in operation in France with an aggregate annual capacity of approximately 170 million tons; this was one refinery less and 1.5 million tons per year less capacity than in 1977.

Management of Esso SAF decided to increase capacity of the desulfurization installation from 3,700 tons per day to 6,900 tons per day at the refinery at Fos sur Mer. The contract, valued at 200 million francs, was awarded to Foster Wheeler. At Port-Jerome, another Esso SAF refinery, a decision was made to build a new dewaxing unit with a capacity of 367,000 tons of dewaxed lubricants. The French company, Technip, was chosen to be the contractor. Completion was scheduled for mid-1980's, but costs were not made public.

Uranium.—France continued development of its nuclear powerplants to assure a total capacity of 40,000 megawatts of electrical power, or 50% or total electric generating capacity, by 1985. France has the industrial capability to build standardized 900-megawatts of electrical power nuclear plants, mostly light-water reactors (LWR). At the beginning of 1978 through 1979, four LWR (900 megawatts of electrical power) powerplants were operational; and total capacity was 6,400 megawatts of electrical power. At yearend, 26 plants of 900-megawatts of electrical power capacity, and six plants of 1,300-megawatts of electrical power capacity were under construction. In addition, plans were announced for construction of eight additional 1,300 megawatts of electrical powerplants.

The French Government and the private sector also were active in mining and processing uranium. Domestic mine output of uranium met about 50% of demand in 1978 and 1979, but France's dependence on African uranium was growing. In 1985, France might produce only 20% of its uranium needs. However, depleted uranium from LWRs, about 80,000 tons, should constitute sufficient resources for over two centuries of French energy requirements. With its plant at La Hague, France could become the leader in the field of commercial reprocessing of oxide fuels.

The Government-owned Compagnie Général des Matières Nucléaires(COGEMA) was the largest uranium producer, with mines at Limousin, Vendée, and Forez. In addition, uranium was produced by Société Central de l'Uranium (SCMURA) at Cantal-Creuse; Compagnie Francaise des Minerais d'Uranium (CFMU) at Lozen and Creuse; Société Industrielle er Minière d'Uranium du Centre (SMUC), a subsidiary of CFMU, COGEMA, and Société des Asphaltes du Centre, at Correze.

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[1] Physical scientist, Branch of Foreign Data.

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The Mineral Industry of Gabon

By Candice Stevens[1]

In the late 1970's, Gabon ranked as Africa's fifth largest petroleum producer, the world's third largest manganese producer, and an important supplier of uranium. The mineral sector was the dominant contributor to the country's economy and accounted for about 60% of the gross national product (GNP) in 1978 and 1979. Ambitious investment plans, however, left the country suffering from an external debt of over $2 billion[2] in 1978. A shortage of foreign exchange was compounded by an inflation rate of 20%, declining petroleum production, and escalating costs for Gabon's major development project, the Trans-Gabon Railroad. In 1978, Gabon adopted an austerity program with technical and financial aid from the International Monetary Fund (IMF). The ambitious third 5-year plan (1976-80) was scaled down from its original planned expenditure of $3.5 billion. In 1979, the economic stabilization program acted to lower the inflation rate to 11%, reduce the external debt to $1.6 billion, and improve the balance of payments. Gabon was preparing a moderate fourth 5-year plan (1981-85) in consultation with the IMF.

Emphasis was placed on petroleum and mineral exploration in Gabon. Extensive prospecting for gas and oil was ongoing both onshore and offshore by a number of foreign companies. The National Geologic Service in conjunction with the Bureau de Recherches Géologiques et Minières (BRGM) (France) continued its geologic survey and mapping program. The focus was on lead-zinc anomalies in the Kroussou region and copper occurrences in the Mayumba and Nyanga regions. The Gabonese Government was negotiating with Aeroservice Corp. (United States) for a project aerial survey of Gabon's mineral resources which was to provide the basis for a new series of geological maps and an overall mineral development strategy. Also in 1978, Gabon was host to a conference of manganese-producing countries who discussed means of improving the global terms of exchange and trade in manganese.

Completion of the Trans-Gabon Railroad was postponed from 1981 to 1987 as construction of the 700-kilometer line fell behind schedule. In December 1978, the first working segment linking Owendo and N'Djole was inaugurated. Yet to be completed were a 155-kilometer section between Booue, Moanda, and Franceville. It had not yet been decided whether to construct a third section between Booue and Belinga, a distance of 250 kilometers. It was estimated that $900 million had already been spent on the railroad, which was to link the Moanda manganese mines, the Mounana uranium mines, and the Belinga iron ore deposits to a new deepwater port at Santa Clara. Construction by EUROTRAG, a 13-company European consortium, was under the general supervision of the Office du Chemin de Fer Trans-Gabonais (OCTRA).

A $100 million mineral port was under construction at Santa Clara, located 25 kilometers north of Libreville, by Soros Associates (United States). The port complex included 800 meters of protective breakwater, storage capacity of 4 million tons, and berths to accommodate ore carriers up to 280,000 deadweight tons. Initially, 150,000-deadweight-ton ore carriers were to be loaded at a rate of 10,000 tons per hour. Completion of the port was to coincide with commissioning of the Trans-Gabon Railroad.

PRODUCTION AND TRADE

Although uranium production increased in 1978 and 1979, production of Gabon's other principal mineral commodities—manganese and petroleum-evidenced a decline. Gabon also produced small amounts of gold and nonmetallic minerals. Mineral production in 1978 was valued as follows: petroleum ($1.1 billion), uranium ($96 million), manganese ($112 million), cement ($12 million), gold ($250,000), and marble ($212,000).

Gabon's balance-of-trade surplus increased from $350 million in 1978 to approximately $500 million in 1979 owing to increased prices for its mineral exports. Petroleum exports accounted for about 72% to 75% of export earnings. Principal destinations of oil exports in 1978 were the United States (24%), Argentina (15%), and France (14%). Mandji crude (79% of exports) was exported from the Cape Lopez terminal, while Gamba crude (16% of exports) and Lucina crude (5% of exports) were exported from their respective loading facilities. Gabon was a member of the Organization of Petroleum Exporting Countries (OPEC) and raised its petroleum prices in accordance with OPEC policy. In 1978, Gabon exported manganese to the United States (33%), France (19%), and Spain (11%). Prior to 1979, Gabon exported all uranium production to France under an exclusive contract. However, at yearend 1978, Gabon concluded an agreement with Azienda Generale Italiani Petroli SpA (Italy) to export 1,500 tons of uranium metal over an 11-year period.

Table 1.—Gabon: Production of mineral commodities

Commodity[1] and unit of measure	1976	1977	1978[p]	1979[e]
Cement, hydraulic metric tons	107,000	190,000	[e]190,000	200,000
Gas, natural:				
Gross million cubic feet	64,484	61,694	64,449	64,000
Marketed do	5,968	6,250	5,827	6,000
Gold, mine output, metal content troy ounces	3,086	2,572	965	100
Manganese:				
Ore, gross weight (50%-53% Mn) metric tons	[r]2,216,759	1,850,529	1,661,020	1,800,000
Pellets, battery and chemical grade, gross weight (82%-85% MnO_2) do	65,000	78,000	93,000	100,000
Total do	[r]2,281,759	1,928,529	1,754,020	1,900,000
Petroleum:				
Crude thousand 42-gallon barrels	82,042	79,032	76,176	70,991
Refinery products:				
Gasoline do	1,260	1,058	1,142	[2]650
Jet fuel and kerosine do	870	730	2,308	[2]740
Distillate fuel oil do	2,845	5,073	3,275	[2]2,286
Residual fuel oil do	4,554	3,650	5,662	[2]4,150
Other do	695	1,971	2,496	[2]684
Refinery fuel and losses do	999	---	584	[2]274
Total do	11,223	12,482	15,417	[2]8,984
Uranium oxide (U_3O_8), content of concentrate metric tons	1,085	932	1,022	1,000

[e] Estimate. [p] Preliminary. [r] Revised.

[1] In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) is also produced, as well as diamond from artisan works, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

Table 2.—Gabon: Exports of mineral commodities

Commodity and unit of measure	1975	1976	Principal destinations, 1976
Manganese ore metric tons	1,968,000	2,217,000	United States 932,022; France 437,602.
Petroleum, crude thousand 42-gallon barrels	75,631	76,739	France 32,240; United States 13,055; Caribbean Islands, n.e.s., 10,505; Bahamas 9,513.
Uranium and thorium ores and concentrates value, thousands	$10,875	$35,055	All to France.

Source: United Nations. Commodity Trade Statistics. 1975 and 1976.

Table 3.—Gabon: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
METALS			
Aluminum metal including alloys, unwrought and semimanufactures	537	385	France 236; Belgium-Luxembourg 103.
Copper metal including alloys, unwrought and semimanufactures	5,536	80	France 66.
Iron and steel semimanufactures:			
Bars, rods, angles, shapes, sections	26,178	29,617	France 25,222; Belgium-Luxembourg 3,564.
Plates and sheets	7,103	8,070	France 6,643.
Hoop and strip	--	172	NA.
Rails and accessories	1,026	20,930	Mainly from France.
Wire	1,710	1,459	France 858; Belgium-Luxembourg 197.
Tubes, pipes, fittings	48,004	39,135	France 21,523; Japan 6,332; United States 5,046.
Castings and forgings, rough	--	147	All from France.
Total	84,021	99,530	
Zinc metal including alloys, unwrought and semimanufactures	34	NA	
NONMETALS			
Abrasives:			
Natural	633	NA	
Grinding wheels and stones	46	132	Mainly from France.
Cement, hydraulic	138,951	183,840	France 101,306; Angola 46,884; Ivory Coast 20,124.
Clay products:			
Refractory	110	18	Mainly from France.
Nonrefractory (including brick)	5,424	3,264	France 2,064; Italy 508; West Germany 380.
Salt	1,914	1,685	France 161.
Stone, sand and gravel:			
Crude and partly worked:			
Calcareous stone	3,642	572	NA.
Gravel and crushed rock		12,329	Mainly from France.
Other		155	NA.
Building stone, worked	NA	176	NA.
Sulfur, elemental	NA	3,023	All from France.
Other, crude:			
Refractory minerals	5,766	3,833	United Kingdom 1,549; Senegal 1,050; Spain 512; France 392.
Unspecified	332	13,674	France 10,417; Morocco 1,751.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	9	11	Mainly from Netherlands Antilles.
Lubricants do.	42	30	France 16; Belgium-Luxembourg 10.
Bitumen and petroleum coke do.	83	13	Spain 11.
Other do.		3	NA.
Total do.	134	57	

NA Not available.

Source: United Nations. Commodity Trade Statistics. 1975 and 1976.

COMMODITY REVIEW

METALS

Gold.—Production of gold in Gabon has declined drastically in recent years owing to the depletion of reserves. From 11,000 troy ounces in 1970, output fell to approximately 100 troy ounces in 1979. Gold was produced by smallworkers in the areas of Eteke, Lastoursville, Makokou, and Ndjole and was sold by the Sociètè Gabonaise de Recherche et d'Exploitation Minière (SOGAREM). The number of workers was reported to have fallen from over 2,000 in the early 1970's to less than 100 in 1979.

Iron Ore.—The decision on whether to exploit the Belinga iron ore deposits, located in northeastern Gabon, was postponed until 1982. Exploitation of the deposits was dependent on the completion of a 250-

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kilometer section of the Trans-Gabon Railroad linking Booue and Belinga. A study completed by Bethlehem Steel Corp. (United States) in 1978 indicated reserves of 300 million tons averaging 65% iron. The proposed open pit mine at Belinga was to produce between 7.5 million and 10 million tons per year of iron ore commencing in the 1980's. Development of the deposits at an estimated cost of $100 million was to be financed by a European consortium, The Sociètè des Mines de Fer de Mekambo (SOMIFER). Shares in SOMIFER were held by the Gabonese Government (41%), Bethlehem Steel (20%), Exploration Bergbau (Federal Republic of Germany) (10%), Industrialexport (Romania) (5%), Finsider (Italy) (3.5%), BRGM (3%), Solmer (2.4%), Banque de Paris et de Pays-Bas (1%), Hoogovens (Netherlands) (0.5%), and a Japanese group (13.6%). Gabon's other iron ore deposits—at Kokomenguel in the northeast, Latoursville, and Tchibanga in the southwest—were estimated to contain reserves of 1.2 billion tons.

Manganese.—Gabon was the world's largest producer of manganese from a single mine. The country's manganese resources were distributed over five plateaus surrounding Moanda, situated 50 kilometers west of Franceville in the southeast. Reserves at the Bangombe deposit, now under exploitation, were estimated at 100 million tons of ore grading 51% manganese. Reserves at the Okouma plateau, north of Moanda, were estimated at 100 million tons of ore grading 45% to 50% manganese. Reserves of the Yeye, Messando, and Boouba plateaus had not yet been evaluated.

Open pit mining at Moanda was under the direction of Cie. Minière de l'Ogooue SA (COMILOG), owned by the U.S. Steel Corp. (44%), the BRGM (19.8%), the Cie. de Mokta (17.1%), the Gabonese Government (10%), and the Sociètè Auxiliare du Manganese de Franceville (9%). The Gabonese Government was also planning to acquire a 10% to 25% interest in any venture to exploit the Okouma deposit. Production capacity was to increase from 2.7 million tons per year in 1979 to 4 million tons per year following the completion of the Trans-Gabon Railroad. Production capacity in 1979 was limited by the capacity of the chain-conveyer system which transported ore from Moanda to M'Binda on the Congolese border for eventual export from the port of Pointe Noire in the Congo.

High-grade manganese ore was used in the manufacture of batteries at the plant owned by the Sociètè Gabonaise des Piles (SOGAPIL). Production capacity in 1979 was rated at 12 million 1.5-volt batteries per year which were sold for domestic use and exported to the Congo and Zaire. SOGAPIL was owned by the Gabonese Government (20%), Wonder Inc. (20%), and COMILOG (20%), with the remaining shares divided among private banks and individuals.

The construction of a ferroalloys plant at Franceville was dependent on the completion of the Trans-Gabon Railroad and the Grand Poubara dam. The $100 million project was under study by the Sociètè Gabonaise des Ferroalliages (SOGAFERRO) whose principal shareholders were the Okura Trading Co. Ltd. (25%), COMILOG (15%), and the Gabonese Government (10%). Production capacity was planned as 85,000 tons of ferromanganese and 50,000 tons of silicomanganese per year.

Uranium.—Underground exploitation of the Oklo mine began in 1978, and a new yellowcake plant began production in that year. Production by the Compagnie des Mines d'Uranium de Franceville (COMUF) was to reach 1,500 tons of uranium metal by 1982. The construction of infrastructure began in 1979 on the nearby Boyindzi deposit, and the Okelobondo deposit was under evaluation. Total reserves at the three deposits, located in the Mounana area 25 kilometers north of Moanda, were estimated at 20,000 tons of uranium metal. Ore was processed at the new Mounana plant which produced yellowcake containing 70% to 75% uranium metal. Concentrates were sold under contract to the French Commissariate à l'Ènergie Atomique (CEA). A tax revision agreement between COMUF and the Gabonese Government in 1976 provided for greater host Government revenues and a gradual increase in production in the next few years.

Gabon concluded two new agreements with the CEA for uranium exploration. A consortium including the CEA, Union Carbide Corp. (United States), and Leon Tempelsman Co. (United States) was to prospect in the Latoursville-Booue region. A second venture, including the CEA and Power Reactor and Nuclear Fuel Development Corp. (Japan), acquired the Estuary concession covering 4,000 square kilometers in the Cocobeach region.

NONMETALS

Barite.—The BRGM located a small deposit of barite near Mayumba in the southern coastal region. Reserves were estimated at 500,000 tons. Studies were being conducted on the possible exploitation of the barite deposit for use as drilling weight in petroleum production.

Cement.—Production of cement was at low levels owing to a mechanical breakdown in the Sociètè des Ciments d'Owendo clinker-grinding plant. Production capacity of the plant, whose principal shareholders were the Gabonese Government (20%) and Ciments Lafarge SA (France) (71.3%), was 270,000 tons per year. A second clinker-grinding plant, with an annual production capacity of 100,000 tons, was under construction at Franceville by the Sociètè des Ciments de Gabon. To reduce dependence on imported clinker, a new plant at N'Toum was to produce 350,000 tons of clinker per year from local limestone deposits. Shareholders in the Franceville and N'Toum plants were the Gabonese Government (51%), Elf Gabon (19%), Ciments Lafarga (15%), and Sociètè des Ciments d'Owendo (15%).

Talc.—BRGM reported a large talc deposit in the Tchibanga region of Nyanga Province. Reserves were estimated at 100 million tons. Evaluation of the deposits was to continue in 1980. The Gabonese Government was negotiating a $10 million joint venture with Talc d'Usines SA (France) to exploit the deposit.

MINERAL FUELS

Natural Gas.—Gabon's natural gas reserves were estimated at 70 billion cubic meters. Most of the country's associated gas production was flared. Approximately 10% of output was used in power generation and petroleum production.

Petroleum.—*Production.*—Gabon's petroleum production was expected to continue its slow decline if no new substantial discoveries were made. The oil basin of Gabon, approximately 645 kilometers long and 240 kilometers wide, extends along the West African coast south of the Gulf of Guinea. Although there are a few large oilfields, most of the fields are of moderate size and approximately 80% of oil production originates from offshore deposits. Recoverable oil reserves were estimated at 66 million barrels.

Elf Gabon, owned 25% by the Gabonese Government and 75% by Essence et Lubrificants de France-Enterprise de Recherches et d'Activitès Petrolièrs (Elf-Erap), accounted for over 80% of Gabon's production. Gabon's largest field, the Grondin, produced about 50,000 barrels per day of Madji crude. Elf Gabon also held several joint production ventures with other oil companies including Shell Gabon, Gulf Oil Co., Mitsubishi (Japan), and Ocean Drilling and Exploration Co. (United States). Elf Gabon (20%), Shell Gabon (50%), and Gulf Oil Co. (30%) planned to increase production at the offshore Lucina Field from 11,000 barrels per day to 15,000 barrels per day in 1980. Production at the Gamba Field, operated by Shell Gabon, was declining at the rate of 10% per year, and the field was estimated to be 80% depleted. In June 1979, the Gabonese Government established the Sociètè Nationale des Pètroles Gabonais (PETROGAE) and required all petroleum producing companies to deliver 25% of annual output to the national company.

Exploration.—Permits for petroleum exploration were held by about 25 foreign companies prospecting on a total of 46,000 square kilometers onshore and 61,000 square kilometers offshore. The terms of the exploration agreements required producing companies to reinvest up to 10% of their profits in domestic industrial enterprises, Government participation of 25% in case of commercial discovery, refining of 50% of crude output in local facilities, transport of 50% of output by the Gabonese National Maritime Transport Co., the employment and training of local personnel where possible, royalty rates of 20%, and tax rates of 73%. For the first time, the Gabonese Government contributed capital in 1978 to become a partner in exploration activities with British Petroleum, Preussag AG (Federal Republic of Germany), and INA Naftaplin (Yugoslavia). The most active company engaged in oil exploration was Elf Gabon with shares in five offshore and three onshore concessions. Two new discoveries made in the onshore Mayumba tract were under study for possible exploitation by 1981.

Refining.—The Sociètè Gabonaise de Raffinage (SOGARA) refinery at Port Gentil had an annual production capacity of 12 million barrels. The refinery was supplied by crude from the deposits of the Mandji Isle by an 18-kilometer pipeline. SOGARA was owned 51% by the Gabonese Government, 18.75% by Elf Gabon, 18.75% by the

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Compagnie Francaise des Pètroles (CFP), and 11.5% by a group of petroleum marketing companies. Production was sold on the domestic market and exported to Cameroon, the Central African Republic, and the Congo. A second refinery came onstream in Port Gentil in 1977 but had yet to reach full capacity. The Compagnie Gabonaise-Elf de Raffinage (COGER) refinery was to produce 10 million barrels per year of petroleum products for export to Western European countries. COGER was owned 30% by the Gabonese Government and 70% by Elf Gabon.

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[1] Economist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Communautè Financière Africaine francs (CFAF) to U.S. dollars at the rate of CFAF240 = US$1.00.

The Mineral Industry of the German Democratic Republic

By George Rabchevsky[1]

As the German Democratic Republic (GDR) marked its 30th anniversary on October 7, 1979, domestic economic growth showed a poor record in all sectors. The country's foreign trade deficit continued, totaling 7.4 billion marks (M)[2] in 1978. Economic growth for 1978 was less than planned and was even worse for 1979; for the first time, the Government did not publish even the semiannual national income figures. Since the founding of the GDR, the U.S.S.R. has supplied the equipment and machinery necessary for the development of the GDR's material and technical base, as well as raw materials and semifinished products.

In 1978 and 1979, the GDR remained the world's leading producer of lignite and potash, producing approximately 27% and 12%, respectively, of total world output. The GDR is relatively poor in all other raw materials and depends significantly on imports for most of its mineral requirements. The net national product (income) grew 4.0% in 1978, and target growth for 1979 was set at only 4.3%. Industry, the backbone of the economy, accounts for 60% of the net national product and employs approximately 40% of the working population. In 1978, industrial production totaled M99.6 billion, up 5.4%, which was just below planned growth of 5.7% and the same as the 1977 growth. The 1979 target growth of industrial production was set at 5.5%, reflecting continued heavy emphasis on the development of industry, with particular stress on expansion of the coal and energy, electronics and data processing, mechanical engineering, and chemical sectors. To achieve the projected productivity, the GDR is developing and introducing labor-saving technologies, and a modest organizational reform has been introduced in industry. This reform increases the number of vertically integrated, semiautonomous "combines" and places greater authority and responsibility in the hands of combine directors. Some of the new combines are now authorized to conduct business with foreign firms.

Overall 1978 actual investment in the economy was 3% over that of the previous year, in contrast to the 2.1% planned increase. In 1979, overall investment was planned to rise 5.6% over that of 1978. Of total industrial investments, 60% was allocated to the fuel and energy, metalworking and metallurgy, prospecting and geology, and chemical sectors. The pace of investment is being accelerated in an effort to replace obsolete industrial plants and raise productivity. The export industry sector was to get the largest share of investments in 1978 and 1979 in order to meet the respective 11% and 10% expansion goals for foreign trade turnover. In 1978, however, the foreign trade turnover fell short of its goal, increasing only 8.9%. In 1978, trade revenues rose 3.5% to M124.9 billion (a 4% increase was planned), and an increase of 5% was planned for 1979. Expenditures in 1978 were the same as in 1977, at M124.1 billion (a 5% increase was planned), and a 5% increase to M137.4 billion was planned for 1979.[3]

In summary, the GDR's economic growth in 1978 and 1979 slowed in almost all sectors, coinciding with rising costs for imported oil, raw materials, and capital goods, forcing the country to take up new loans abroad. In addition, the particularly hard winter of 1979 severely affected the entire economy, even forcing the dismissal of Klaus Seibald, Minister of Coal and Energy.

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Future economic programs of the GDR will depend to a large extent on solving problems caused by shortages of fuel and raw materials.

PRODUCTION

Although the GDR is the world's leading producer of lignite and potash, it is considered overall to be a mineral-poor country. The only other mineral commodities of any commercial significance are salt, building sand, and a moderate amount of natural gas. Small quantities of copper and tin are also mined for domestic consumption. The GDR depends heavily on the U.S.S.R. and Council for Mutual Economic Assistance (CMEA)[4] countries for supplies of most raw materials.

Conservation of raw materials and energy and the use of scrap are constantly emphasized. The Ninth Socialist Unity Party of Germany (SED) Congress, for example, set a target to increase the use of secondary raw materials and scrap 30% by 1980. As a conservation measure, the machine tool industry has undertaken to reduce usage of rolled steel in 1979 by 5,850 tons, pig iron by 5,050 tons, and steel castings by 1,400 tons or 4% from that of the previous year. Thus, the 5.5% planned increase in industrial production for 1979 was to be achieved with only 1.7% more primary raw materials. The following tabulation shows the usage of scrap materials (from domestic sources, imports, and stockpile) by the metallurgical industry in 1977 and 1978, in thousand tons:

	1977	1978
Steel scrap	5,868	5,842
Scrap castings	428	426
Copper and alloy scrap	49	50
Lead and alloy scrap	41	45
Zinc and alloy scrap	19	19
Aluminum and alloy scrap	54	53

Source: Neues Deutschland (The New Germany), East Berlin. Apr. 10, 1979, p. 2.

The combines of the Ministry of Coal and Energy were slightly short of their production targets in 1978, but those of the Ministry of Ore Mining, Metallurgy, and Potash slightly exceeded their production quotas. Production of alumina and aluminum metal in 1978 and 1979 dropped slightly. Copper production was also down from that of 1977, while iron and steel production was up slightly. Lead, nickel, tin, and zinc production also showed small gains. No significant gains were made in the nonmetals sector except in potash production, which rose, as expected, about 3%. Lignite, the major mineral commodity of the GDR, and bituminous coal both registered production declines in 1978. Production of manufactured gas showed a 7% gain, while that of natural gas and crude oil was almost unchanged. The GDR has been increasing its imports of crude oil in the past few years, and in 1978 and 1979 there was a corresponding increase in the total output of refinery products.

Table 1.—German Democratic Republic: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Alumina	44,468	38,953	37,585	36,000
Metal, primary[e]	60,000	65,500	60,000	64,500
Cadmium metal, primary[e]	[r]20	[r]20	20	20
Copper:				
Mine output, metal content[e]	16,000	17,000	16,000	16,000
Metal:				
Smelter[e]	[r]16,000	18,000	17,000	17,000
Refined, including secondary	50,000	51,000	49,000	49,000
Iron and steel:				
Iron ore, gross weight[2] thousand tons	60	66	80	70
Pig iron do	2,528	2,628	2,560	2,490
Ferroalloys[3] do	154	154	164	154
Crude steel do	6,732	6,850	6,976	7,100
Semimanufactures (hot-rolled only) do	4,593	4,802	5,003	5,230
Lead:[e]				
Mine output, metal content, recoverable	4,000	--	--	--
Metal, refined, including secondary	36,000	37,000	38,000	38,000
Nickel:[e]				
Mine output, metal content, recoverable	2,500	2,500	2,700	2,700
Metal, refined	2,800	2,800	3,000	3,000

See footnotes at end of table.

Table 1.—German Democratic Republic: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978^{p}	1979^{e}
METALS —Continued				
Silver, mine output, metal content, recoverable^{e} thousand troy ounces	1,600	1,600	1,600	1,600
Tin:^{e}				
Mine output, metal content, recoverable	1,300	1,400	1,600	1,600
Metal, including secondary	1,200	1,200	1,200	1,600
Zinc metal, including secondary^{e}	15,000	15,500	16,000	16,000
NONMETALS				
Barite^{e}	31,000	31,000	35,000	35,000
Boron materials: Processed borax, $Na_2B_4O_7·10H_2O$ content	4,000	^{e}4,000	^{e}4,000	4,000
Cement, hydraulic thousand tons	11,344	12,102	12,521	13,000
Chalk^{e} do	50	50	50	50
Fluorspar^{e} do	90	100	100	100
Gypsum and anhydrite:				
Crude^{e} do	340	340	340	340
Calcined do	302	304	^{e}305	310
Lime and dead-burned dolomite do	3,404	3,367	3,443	3,500
Nitrogen: N content of ammonia do	1,119	1,130	1,137	1,200
Potash, marketable, K_2O equivalent do	3,161	3,229	3,323	3,400
Pyrite, gross weight^{e} do	25	25	25	25
Salt:				
Marine do	52	53	^{e}53	53
Rock do	2,508	2,590	2,688	2,700
Total do	2,560	2,643	2,741	2,753
Sodium and potassium compounds, n.e.s.:				
Caustic soda	440,589	423,486	414,988	420,000
Sodium carbonate	828,998	839,561	852,260	854,000
Sodium sulfate	149,218	137,579	130,799	127,000
Stone, sand and gravel:				
Crushed stone thousand tons	13,836	14,561	14,566	15,000
Sand and gravel do	8,218	8,359	8,477	9,000
Sulfur:				
Byproduct:				
Elemental do	79	^{e}80	^{e}80	80
Other forms do	250	260	270	270
From pyrite^{e} do	10	10	10	10
Sulfuric acid do	957	927	^{e}900	970
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Bituminous do	457	349	115	--
Lignite do	246,897	253,705	253,264	255,000
Total do	247,354	254,054	253,379	255,000
Coke:				
From anthracite and bituminous coal do	1,693	^{e}1,600	^{e}1,500	1,500
From brown coal:				
High temperature do	2,123	2,240	2,297	2,350
Low temperature do	3,362	3,020	2,857	2,600
Total do	5,485	5,260	5,154	4,950
Fuel briquets (from lignite) do	48,679	48,749	48,468	49,970
Gas:				
Manufactured million cubic feet	194,300	208,517	218,138	218,500
Natural, marketed production do	304,520	300,343	302,426	302,000
Petroleum:				
Crude^{e} thousand 42-gallon barrels	^{r}392	^{r}392	392	392
Refinery products:				
Gasoline do	25,348	26,205	27,515	28,000
Kerosine, jet fuel, distillate fuel oil do	38,823	41,048	42,583	43,500
Residual fuel oil do	58,844	56,850	58,740	59,000
Lubricants do	2,666	2,738	2,817	2,900
Asphalt do	6,596	7,268	^{e}7,500	8,000
Total[4] do	132,277	134,109	139,155	141,400

^{e}Estimate. ^{p}Preliminary. ^{r}Revised.

[1] In addition to the commodities listed, magnesium, peat, and a variety of crude construction materials are produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] Source indicates that data include "roasted ore," presumably roasted pyrite.

[3] Series revised; figures represent the sum of estimates for silicon metal production (3,000 tons in 1976 and 1977 and 4,000 tons in 1978 and 1979) and reported figures for output of all other ferroalloys (except those for 1979 which are estimated).

[4] Total of listed products only; no estimates have been made for unreported products and/or for refinery fuel and losses.

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TRADE

In 1978 and 1979, the GDR imported about 60% of its total raw materials and fuel and energy requirements. During this period, about 35% of industrial production was exported.[8] In 1978, the total foreign trade turnover increased 8.9% to M99.6 billion. In 1979, the foreign trade turnover exceeded the M100 billion level for the first time. Exports in 1978 amounted to M46.1 billion, and imports hovered at M53.5 billion, resulting in a record high trade deficit of M7.4 billion.

Imports of metals are of great significance to the machine-building industry, which is one of the country's most important industrial branches. The required raw products are almost totally imported. In 1978, for example, the pig iron output of 2.6 million tons was made possible by iron ore imports of about 2.0 million tons, and voluminous imports of steel products supplemented the domestic raw steel output of 7.0 million tons. In 1978, as in previous years, the GDR's mineral exports consisted primarily of potash, lignite, rock salt, iron and steel semimanufactures, and some petroleum products. Exports of equipment, machinery, and technical services were stepped up. Reportedly, much of the world's lignite is mined with open pit equipment manufactured in the GDR, including large excavators and conveyor bridges. The U.S.S.R. reportedly placed the largest order ever with the GDR's chemical engineering and equipment industry in 1978. During the 1976-80 period, 26 complete oil refineries are to be supplied to the Tyumen area of Western Siberia, each capable of refining 3.5 million tons of oil per year. The Soviet order also included equipment for processing natural gas.

Approximately two-thirds of the GDR's trade is conducted under bilateral arrangements with other centrally planned economy countries, particularly CMEA members. The GDR provides industrial products, especially machinery, in return for imports of primary products, fuels, and raw materials from Eastern Europe. The GDR's growing trade deficit with CMEA countries continued to be a troublesome factor in its 1978 and 1979 economic development. The U.S.S.R. is the GDR's largest trade partner, and trade between the two countries in 1978 increased 11.3% over that of 1977. All of the GDR's imports of cadmium, lead, pyrite, and carbon black came from the U.S.S.R., as did most of its chromite, iron ore, zinc, asbestos, coke, crude petroleum, and mineral tar and other coal-, petroleum-, and gas-derived crude chemicals. Growth in foreign trade between the two countries was planned for the 1976-80 period. During this period, the U.S.S.R. was to supply the GDR with more than 88 million tons of oil, 21.6 billion cubic meters of natural gas, 21 million tons of coal, and approximately 16 million tons of rolled ferrous metals, as well as large quantities of iron ore and nonferrous metals. An agreement was reached with the Soviet firm Raznoimport for the import of 27,000 tons of nonferrous metals from the U.S.S.R. in 1979, including copper, aluminum, nickel, and zinc.[9] By participating in exploration and development of Soviet deposits, the GDR has assured itself of future procurements from those deposits. Such investment partnerships, which the GDR and the other CMEA countries have entered into, primarily in the energy sector, represent compensation agreements which are spread out over time. Customarily, the GDR supplies preliminary or preparatory services, that are repaid by the U.S.S.R. through raw materials shipments. For such agreements, the GDR plans to invest about M7 billion in the 1970-80 period, or 3% of total planned investments. The U.S.S.R., however, is no longer willing to bear the investment burdens for additional raw materials shipments by itself. Therefore, the continued supply of raw materials and fuels has included an obligation to participate in the increased investment expenditures of the U.S.S.R.

By constrast, the GDR's trade with the industrialized West, dominated by trade with the Federal Republic of Germany (FRG), primarily involves imports of capital equipment and raw materials in exchange for deliveries of chemicals, industrial and light manufactures, and agricultural raw materials. After a drop in 1977, imports from the West in 1978 and 1979 again rose faster than exports, increasing the GDR's deficit. Imports from the FRG rose 4% in 1978, while exports dropped 2%. Imports exceeded average levels in the chemical, nonferrous metals, and iron and steel industries. There were no outstanding trends in exports to the FGR in 1978. The generally weak development of inter-German trade in

1978 is most evident when broken down by commodity group. The following tabulation summarizes the inter-German trade trends for selected mineral commodities:

Commodity	Value	(Million Deutsche marks[1])		Percent change from previous year	
	1976	1977	1978	1977	1978
GDR IMPORTS					
Iron and steel (including products)	519.3	424.3	453.4	-18.3	+6.9
Hot wide stripping	66.4	71.6	89.2	+7.8	+24.6
Steel sheets	70.5	71.8	52.1	+1.8	-27.4
Tubular steel products	87.0	58.1	74.9	-33.2	+28.9
Drawn and cold-rolled products	78.1	71.7	58.0	-8.2	-19.1
Nonferrous metals	214.8	302.7	335.2	+40.9	+10.7
Stone and earth	47.2	55.8	45.1	+18.2	-19.2
Mining products, n.e.s	478.6	487.3	372.9	+1.8	-23.5
Coal and coke	131.4	123.0	118.2	-6.4	-3.9
Petroleum and natural gas	327.8	347.8	244.6	+6.1	-29.7
GDR EXPORTS					
Iron and steel	277.5	268.0	254.2	-3.4	-5.1
Rolled steel	201.2	196.0	178.9	-2.6	-8.7
Nonferrous metals	101.0	142.2	147.6	+40.8	+3.8
Stone and earth	83.8	79.8	76.3	-4.8	-4.4
Brown coal	100.4	90.1	89.5	-10.3	-.7
Crude gasoline and fuels	544.8	560.0	551.3	+2.8	-1.6

[1] The Deutsche mark (DM) is currently convertible to U.S. dollars at the rate of DM1.8672=US$1.00.

Source: DIW Wochenbericht (Weekly Report), West Berlin. V. 46, No. 10, Mar. 8, 1979, pp. 111-116.

A long-term bilateral energy agreement for 1980-85 was signed between the GDR and the FRG at the Leipzig Fall Fair in 1979. During this period, the GDR plans to import 950,000 tons of crude oil annually, in return for 1.8 million tons of petroleum products. The GDR also plans to import hard coal worth 250 million Deutsche marks (DM),[7] from the FRG. In 1978, the GDR imported hard coal from the FRG worth DM100,000. The 1979 agreement is significant because the import of oil and hard coal from the FRG was included in the long-term agreement for the first time.

Trade agreements in 1978 included agreements for importing chromium ore, copper, and copper cables from Albania and increasing imports of iron ore and mica from India. The GDR exported services and cooperative projects such as those for development of lignite mining in India's Kutch region and the supply of equipment for a cement plant. In the past 7 years, trade with Cuba has doubled and is now approaching an annual value of M1 billion. The GDR plans to export potash fertilizer to and import nickel from Cuba. In 1978 and 1979, a new turnkey cement works was being built by the GDR at Cienfuegos in Havana, Cuba, with a projected production capacity of 4,950 tons per day, which would make it the largest cement works in Latin America. In the 1981-83 period, a complete small- and medium-section rolling mill is to be supplied to the Jose Marti iron and steel works near Havana by the Ernst Thaelmann combine of Magdeburg. This combine also plans to deliver a small-section rolling mill to Uzbekistan in the U.S.S.R.

According to a 1979 trade agreement, exports to Hungary included 500,000 tons of lignite briquets, 250,000 tons of chemical fertilizers, and 250,000 tons of cement. Imports from Hungary included aluminum but consisted mostly of nonmetallurgical commodities.

Table 2.—German Democratic Republic: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Alumina	3	--	
Metal including alloys:			
Scrap	5,077	2,997	Netherlands 1,923; France 915.

See footnotes at end of table.

Table 2.—German Democratic Republic: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Aluminum —Continued			
Metal including alloys —Continued			
Unwrought	21,692	24,080	West Germany 23,097;[3] Japan 498.
Semimanufactures	5,534	7,344	Poland 4,204; Hungary 3,004.
Chromium oxide and hydroxide	6	--	
Cobalt metal, all forms	--	5	All to France.
Copper metal including alloys:			
Scrap	36	92	Austria 90.
Unwrought	12,120	14,708	West Germany 10,226;[3] Belgium-Luxembourg 3,030.[3]
Semimanufactures	[4]355	178	Austria 169.
Iron and steel metal:			
Scrap	26,206	[3]13,708	Spain 8,180; Austria 2,412; Italy 1,862.
Pig iron	[5]7,595	58,124	Yugoslavia 35,000; Austria 17,062.[3]
Ferroalloys[6]	3,000	1,000	NA.
Steel, primary forms[6] thousand tons	505	374	Italy 158;[3] Belgium-Luxembourg 79;[3] Yugoslavia 39.
Semimanufactures:[6]			
Bars, rods, angles, shapes, sections do.	497	604	Poland 95; Bulgaria 40; Yugoslavia 14; Norway 9;[3] undetermined 411.
Plates and sheets do.	318	286	West Germany 32;[7] France 15;[3] United Kingdom 15;[3] Denmark 12;[3] undetermined 106.
Hoop and strip do.	155	124	Italy 3;[3] France 2;[3] undetermined 119.
Rails and accessories do.	11	11	Belgium-Luxembourg 1; undetermined 10.
Wire do.	60	68	NA.
Tubes, pipes, fittings do.	108	105	Poland 28; Yugoslavia 18; France 10;[3] undetermined 36.
Castings and forgings do.	24	25	Poland 16; France 2;[3] undetermined 7.
Total do.	1,173	1,223	
Lead:			
Oxide	1,028	637	Sweden 347; Yugoslavia 290.
Metal including alloys:			
Scrap	1,119	100	All to Netherlands.
Unwrought	7,611	2,317	United Kingdom 1,063;[3] Austria 689; Netherlands 505.
Semimanufactures			
Manganese oxide	--	5	All to Yugoslavia.
Molybdenum metal, all forms	--	4	All to Sweden.
Nickel:	--	3	Mainly to Italy.
Matte and speiss	58	10	All to Switzerland.
Unwrought	82	218	Netherlands 148; United Kingdom 25;[3] Italy 23;[3] France 22.
Semimanufactures	--	11	United Kingdom 10.[3]
Platinum-group metals, unworked or partly worked value, thousands	--	[3]$12	All to Netherlands.
Silver, unworked or partly worked thousand troy ounces	[4]8,681	7,009	All to United Kingdom.
Tin metal, all forms	15	[3]7	United Kingdom 5; Greece 2.
Titanium oxide, dioxide, anhydride	3,780	3,912	All to Finland.[7]
Tungsten:			
Ore and concentrate	[3]16	--	
Metal, all forms kilograms	--	10	All to Japan.
Zinc:			
Oxides	2,621	2,259	Norway 1,894; Sweden 290.
Metal, unwrought	--	[3]10	All to Greece.
Other:			
Ores and concentrates	--	6	France 3; Spain 3.[3]
Ash and residue, nonferrous	[5]19,957	14,370	Austria 14,038.
Oxides of strontium, barium, magnesium	1,381	--	

See footnotes at end of table.

Table 2.—German Democratic Republic: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Other —Continued			
Metals:			
Metalloids	--	15	Netherlands 10; Austria 3.[3]
Base metals, all forms	--	[3]6	France 5.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum kilograms	--	2	All to Spain.
Grinding and polishing stones	[6]74	[3]154	United Kingdom 70; Greece 49.
Barite	12,266	9,887	Poland 9,849.
Cement thousand tons	[8]1,102	[8]1,131	Hungary 256; Czechoslovakia 55.
Chalk	[7]46,395	[7]36,747	NA.
Clays and clay products:			
Crude:			
Fire clay	1,985	2,078	Poland 2,038.
Fuller's earth, chamotte	--	2,276	France 1,936; Hungary 300.
Kaolin	[7]83,475	[7]87,413	Poland 13,036; Hungary 10,961; Yugoslavia 11,052.
Other	12,652	7,019	Hungary 6,383.
Products:			
Refractory	25,142	12,460	Poland 5,592; Hungary 4,607; Sweden 1,168.
Nonrefractory	[4]4,196	4,597	Yugoslavia 2,493; Sweden 526;[3] United Kingdom 487.[3]
Diamond:			
Gem, not set or strung value, thousands	[5]$40	[3]$243	Netherlands $155; Belgium-Luxembourg $88.
Industrial do	[5]$593	[3]$305	All to Belgium-Luxembourg.
Feldspar and fluorspar	28,858	30,417	Poland 10,922; Austria 7,917; Norway 6,944.
Fertilizer materials:			
Crude:			
Phosphatic	911	797	All to Hungary.
Potassic	[5]25,016	24,370	United Kingdom 12,516; Austria 11,057.
Manufactured:			
Nitrogenous	[5]18,631	15,040	United Kingdom 12,290.
Phosphatic	[5]2,660	--	
Potassic, K_2O content[7] thousand tons	2,740	2,744	Czechoslovakia 537; Poland 344; Hungary 296; India 177; Brazil 176.
Other, including mixed	1,001	3,256	Iceland 2,500;[3] Sweden 530.
Ammonia	30,224	14,308	Poland 8,244; Yugoslavia 3,064; France 3,000.
Graphite	250	350	All to Yugoslavia.
Gypsum, calcined	[7]77,208	[7]68,681	Hungary 39,665; Sweden 24,288.
Lime	9,754	10,354	All to Hungary.
Mica, all forms	1	[3]2	All to Sweden.
Pigments	50	312	Hungary 310.
Precious and semiprecious stones value, thousands	--	[3]$3	All to Italy.
Salt, including rock salt[7] thousand tons	1,145	1,213	Sweden 89; Finland 70; Norway 23.
Sodium and potassium compounds:			
Caustic soda	[6]9,700	[8]11,700	Hungary 6,857.
Caustic potash	[4]1,866	1,412	Hungary 1,184.
Soda ash (Na_2CO_3 content)	[7]298,000	[7]274,800	Czechoslovakia 66,000; Sweden 22,653; Yugoslavia 12,793.
Stone, sand and gravel:			
Dimension stone	[4]820	783	Norway 536; Netherlands 118.
Gravel and crushed rock[7]	285,991	267,881	NA.
Sand, excluding metal bearing thousand tons	2,594	2,476	West Germany 2,429.[7]
Sulfur:			
Elemental	3,185	986	All to Austria.
Sulfuric acid	[7]40,128	[7]41,208	Yugoslavia 9,984.
Other:			
Crude	[5]10,247	10,886	United Kingdom 6,804;[3] Hungary 4,061.
Oxides of strontium, barium, magnesium	[5]1,689	1,279	Sweden 710; United Kingdom 280.[3]

See footnotes at end of table.

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Table 2.—German Democratic Republic: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	4,233	3,487	United Kingdom 1,234; Czechoslovakia 1,176.
Coal:			
Anthracite and bituminous thousand tons	283	315	Poland 312.
Lignite briquets[7] do	2,243	2,211	West Germany 831; Czechoslovakia 396; Austria 168.
Coke do	28	31	Spain 21; Austria 5.
Gas, manufactured million cubic feet	487	456	Mainly to Netherlands.
Peat	--	[3]218	Italy 186.
Petroleum:			
Crude thousand 42-gallon barrels	[5]168	--	
Refinery products:			
Gasoline do	[7]3,596	[7]3,270	NA.
Kerosine and jet fuel do	181	35	Mainly to Hungary.
Distillate fuel oil[3] do	[7]7,872	[7]7,341	Sweden 1,606;[3] Belgium-Luxembourg 417;[3] Denmark 225.
Residual fuel oil do	[9]3,470	[9]2,631	Austria 896;[3] Denmark 668;[3] Hungary 234.
Lubricants do	[9]23	[9]27	Austria 22.[3]
Other:			
Mineral jelly and wax do	84	[3]71	France 12; Netherlands 12; Sweden 9; Austria 8.
Bitumen and other residues do	--	[3]1	Mainly to Austria.
Bituminous mixtures do	--	([10])	All to Austria.
Unspecified do	577	430	All to Poland.
Total do	15,803	13,806	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	[5]2,245	1,500	Switzerland 1,013; Austria 347.

NA Not available.

[1] Unless otherwise specified, data are compiled from the official trade statistics of trading partners. Owing to a lack of official trade data published by the German Democratic Republic, this table should not be taken as a complete presentation of this country's mineral trade. These data have been compiled from various sources, including United Nations information, data published by the trading partners, and partial official trade sources of the German Democratic Republic.

[2] World Metal Statistics, published by the World Bureau of Metal Statistics, London, 1980.

[3] 1978 World Trade Annual, prepared by the Statistical Office of the United Nations, Walker and Co., New York, 1980.

[4] Partial figure; tonnage not available for all destinations.

[5] 1977 World Trade Annual, prepared by the Statistical Office of the United Nations, Walker and Co., New York, 1979.

[6] Source for total trade (which excludes distribution): Quarterly Bulletin of Steel Statistics for Europe, prepared by the United Nations, New York, 1979.

[7] Official trade statistics of the German Democratic Republic.

[8] Metallstatistik (Metallgesellschaft) 1968-1978, Druckerei C. Adelmann, Frankfurt am Main, 1979.

[9] Statistical Yearbook of Member States of the Council for Mutual Economic Assistance, Moscow, 1980.

[10] Less than 1/2 unit.

Table 3.—German Democratic Republic: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite[2]	197,900	251,500	Hungary 190,200; Yugoslavia 40,100.
Alumina	95,101	105,345	West Germany 80,746;[3] Hungary 23,671.
Metal including alloys:			
Scrap	--	45	Hungary 29; Netherlands 16.[3]
Unwrought	52,677	43,117	Yugoslavia 32,071; Hungary 10,731.
Semimanufactures	11,768	14,999	Hungary 8,147; Yugoslavia 5,805.
Bismuth metal, all forms kilograms	--	2,980	All from Japan.
Cadmium metal, all forms do	180	--	
Chromium: Chromite (Cr_2O_3 content)	[8]43,000	[8]51,700	U.S.S.R. 26,000.

See footnotes at end of table.

Table 3.—German Democratic Republic: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Copper:			
Ore and concentrate	[4]28,046	16,954	Sweden 15,794.
Metal including alloys:			
Scrap	1,473	2,162	France 1,162; Belgium-Luxembourg 638.[3]
Unwrought	52,481	64,660	West Germany 35,990;[5] Finland 7,463;[3] Peru 7,270;[6] Poland 7,182.
Semimanufactures	1,877	1,968	Poland 1,484; Austria 255; Sweden 177.[3]
Iron and steel:			
Ore and concentrate, Fe content thousand tons	[3]2,267	[3]2,046	U.S.S.R. 1,382;[3] Sweden 285;[3] India 263.[3]
Metal:[7]			
Scrap do	496	546	U.S.S.R. 351; Belgium-Luxembourg 18; undetermined 177.
Pig iron do	631	804	NA.
Ferroalloys do	29	22	Sweden 2; France 1; undetermined 18.
Steel, primary forms do	1,761	1,911	Poland 49; Austria 12;[3] undetermined 1,847.
Semimanufactures:			
Bars rods, angles, shapes, sections do	813	825	U.S.S.R. 352;[2] Poland 125; Czechoslovakia 80;[2] undetermined 242.
Plates and sheets do	825	693	U.S.S.R. 488;[2] Bulgaria 48; Czechoslovakia 33; Poland 15; undetermined 96.
Hoop and strip do	136	139	Sweden 2;[3] Austria 1;[3] undetermined 133.
Rails and accessories do	234	228	NA.
Wire do	37	36	West Germany 10;[3] Belgium-Luxembourg 3;[3] undetermined 20.
Tubes, pipes, fittings do	337	354	Poland 27; Czechoslovakia 20; Italy 16;[3] undetermined 242.
Castings and forgings do	11	9	NA.
Total do	2,393	2,284	
Lead:			
Oxide	1,077	--	
Metal including alloys:			
Scrap	709	1,196	Switzerland 987; Belgium-Luxembourg 93.[3]
Unwrought	7,050	3,468	Belgium-Luxembourg 3,418.[3]
Semimanufactures	5	8	Yugoslavia 6; Sweden 2.[3]
Magnesium metal	151	175	France 150.
Manganese ore and concentrate, Mn content	[2]81,700	[2]73,400	Mainly from U.S.S.R.
Mercury 76-pound flasks	1,871	5,592	Spain 4,901; Italy 691.
Molybdenum ore and concentrate	NA	59	All from Sweden.
Nickel:			
Matte and speiss	120	144	France 116.
Metal including alloys:			
Scrap	17	[3]16	All from United Kingdom.
Unwrought	100	100	All from France.
Semimanufactures	77	16	Austria 11.
Platinum-group metals, unworked or partly worked value,thousands	--	[3]$3	All from United Kingdom.
Silver metal, unworked or partly worked thousand troy ounces	6,237	4,148	United Kingdom 2,572; Mexico 1,286.
Tellurium, elemental kilograms	592		
Tin:			
Ore and concentrate	--	[3]100	All from United Kingdom.
Metal, all forms	[4]1	1	All from Netherlands.
Titanium:			
Ore and concentrate	204	--	
Oxide, dioxide, anhydride	16,163	16,751	Yugoslavia 12,839; Finland 3,912.[3]

See footnotes at end of table.

Table 3.—German Democratic Republic: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Tungsten:			
Ore and concentrate	[4]43	40	All from Netherlands.
Metal, all forms	[4]1	--	
Zinc:			
Ore and concentrate	--	650	All from Sweden.
Oxide	--	[3]12	United Kingdom 11.
Metal including alloys:			
Unwrought	6,021	593	All from Yugoslavia.
Semimanufactures	557	[e]210	Yugoslavia 137; Belgium-Luxembourg 73.
Zirconium ore and concentrate	540	--	
Other:			
Ores and concentrates	[4]826	[3]4,095	All from Norway.
Ash and residue, nonferrous	[4]3,011	[3]13,542	Spain 12,423.
Oxides, hydroxides, peroxides	233	401	All from France.
Metals:			
Metalloids	556	2,865	Spain 2,160; Norway 655.
Base metals, all forms	[4]512	[e]1,598	Poland 1,010; Japan 558.
NONMETALS			
Abrasives: Grinding and polishing stones	[e]102	80	Austria 42; Sweden 33.
Asbestos[3]	71,400	62,600	Mainly from U.S.S.R.
Boron oxide and acid	3,645	4,210	All from France.
Cement thousand tons	29	32	U.S.S.R. 24.
Clays and clay products:			
Crude:			
Bentonite	14,129	9,989	All from Hungary.
Kaolin[3]	27,500	47,400	United Kingdom 37,669;[3] Czechoslovakia 9,000.
Fire clay	5,816	3,742	All from Poland.
Products:			
Refractory	[e]3,821	6,000	United Kingdom 1,717;[3] Yugoslavia 1,273; Sweden 1,031.[3]
Nonrefractory	[e]780	655	Yugoslavia 190; France 151; Switzerland 141.[3]
Diamond:			
Gem, not set or strung value, thousands	[4]$137	[3]$5	All from Belgium-Luxembourg.
Industrial do	[4]$2,207	[3]$1,857	Belgium-Luxembourg $1,672; Netherlands $185.
Feldspar and fluorspar	16,562	18,279	Sweden 11,224; Norway 7,055.
Fertilizer materials:			
Crude, phosphatic (P_2O_5 content)[3]	506,300	460,200	U.S.S.R. 363,000.
Manufactured:			
Nitrogenous (N content)	[e]52,900	[e]38,400	Poland 7,040.
Phosphatic (P_2O_5 content)[3]	28,500	20,900	West Germany 20,389.
Potassic	[4]10,502	--	
Ammonia	2,193	--	
Graphite[3]	5,725	6,214	NA.
Gypsum and plaster	1	10	Austria 8;[3] Yugoslavia 2.
Lime	3	--	
Magnesite	42,437	37,776	Czechoslovakia 34,131;[3] Greece 3,425.[3]
Mica, all forms[3]	1,116	1,767	India 1,333.
Pigments: Iron oxide	75	18	Belgium-Luxembourg 17.
Precious and semiprecious stones value, thousands	--	[3]$9	Switzerland $5; Belgium-Luxembourg $2.
Pyrite, S content[3]	63,400	39,200	Mainly from U.S.S.R.
Salt	--	[3]6	All from Sweden.
Sodium and potassium compounds: Caustic soda	8,706	9,176	Poland 8,511.
Stone, sand and gravel:			
Dimension stone	537	1,274	Yugoslavia 1,267.
Gravel and crushed rock	3,151	3,485	Hungary 3,118.
Quartz and quartzite	--	[3]22	All from Sweden.
Sand	--	997	Netherlands 989.
Sulfur:			
Elemental	166,500	168,800	All from Poland.[3]
Sulfuric acid[5]	76,500	65,300	NA.
Talc	1,541	1,012	All from Austria.
Other:			
Crude	21,131	23,738	Hungary 23,633.
Slag, dross, other waste	1,217	47,164	Sweden 47,162.
Halogens	NA	54,438	Sweden 49,907; Italy 4,531.

See footnotes at end of table.

Table 3.—German Democratic Republic: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	211	62	Yugoslavia 44.
Carbon black	25,419	24,934	U.S.S.R. 24,634.
Coal:			
Anthracite and bituminous[2] thousand tons	6,058	5,936	U.S.S.R. 3,911; Poland 1,278; Czechoslovakia 603.
Lignite do.	3,387	3,332	All from Poland.
Coke[3] do.	3,065	2,596	U.S.S.R. 960; Czechoslovakia 795; Poland 494.
Gas, natural[9] million cubic feet	125,402	127,729	Mainly from U.S.S.R.
Petroleum:			
Crude[2] thousand 42-gallon barrels	136,060	146,480	U.S.S.R. 130,536; Iraq 7,878; Syria 2,429; Algeria 2,383.
Refinery products:			
Gasoline do.	6	[3]7	Belgium-Luxembourg 4; Italy 3.
Kerosine and jet fuel do.	47	28	Hungary 20; Yugoslavia 8.
Lubricants do.	[9]208	[9]187	NA.
Distillate fuel oil do.	[4]116	[3]129	Denmark 126.
Residual fuel oil do.	[9]160	[9]166	NA.
Other:			
Liquefied petroleum gas do.	--	(10)	Mainly from Sweden.
Mineral jelly and wax do.	--	(10)	All from Netherlands and France.
Bitumen and other residues do.	--	1	Mainly from Sweden and France.
Bituminous mixtures do.	--	(10)	Do.
Unspecified do.	231	510	Poland 430; Romania 80.
Total do.	763	1,028	
Mineral tar and other coal-, petroleum-, and gas-derived crude chemicals	51,862	43,540	U.S.S.R. 41,852.

NA Not available.

[1] Unless otherwise specified, data are compiled from the offical trade statistics of individual trading partners. Owing to a lack of official trade data published by the German Democratic Republic, this table should not be taken as a complete presentation of this country's mineral trade. These data have been compiled from various sources, including United Nations information, data published by the trading partners, and partial official trade sources of the German Democratic Republic.

[2] Official trade statistics of the German Democratic Republic.

[3] 1978 World Trade Annual, prepared by the Statistical Office of the United Nations, Walker and Co., New York, 1980.

[4] 1977 World Trade Annual, prepared by the Statistical Office of the United Nations, Walker and Co., New York, 1979.

[5] World Metal Statistics, published by the World Bureau of Metal Statistics, London; 1980.

[6] Metallstatistik (Metallgesellschaft) 1968-1978, Druckerei C. Adelmann, Frankfurt am Main, 1979.

[7] Source for total trade only: Quarterly Bulletin of Steel Statistics for Europe, prepared by the United Nations, New York, 1979.

[8] Partial figure: tonnage not available for all sources.

[9] Statistical Yearbook of Member States of the Council for Mutual Economic Assistance, Moscow, 1980.

[10] Less than 1/2 unit.

COMMODITY REVIEW

METALS

The GDR is poor in mineral raw materials, has inadequate production for domestic consumption, and consequently is forced to import most of its metal requirements, except perhaps for nickel and tin. The domestic reserves of copper, iron, lead, and zinc ores are almost depleted, so future prospects for domestic metal ore mining are dismal. All of the GDR's bauxite, lead, and zinc ores were imported in 1978 and 1979. The metallurgical industry, however, is well established and functions efficiently using imported ores.

Production of steel increased from 1977 to 1979, while that of pig iron dropped. Production of nonferrous metals fluctuated; an increase was registered for tin, while copper and alumina showed declines.

Reportedly, a cold-rolling mill for casting or extrusion of bars of copper, brass, and nickel alloys was nearing completion in 1978 at Auerhammer. The VEB Berliner Metall und Halbzeug Werke plans to produce sections 20 millimeters in diameter,

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rolled into hexagons and rounds with minimum diameters of 3.35 millimeters and 3.4 millimeters, respectively.[8] A plant in East Berlin also produces copper, brass, and aluminum ingots from secondary materials.

Aluminum.—In 1978 and 1979, aluminum consumption continued the rise that began in 1975, reaching an estimated 225,000 tons per year; output of primary metal, however, dropped slightly to an estimated 64,500 tons. The GDR imports most of its primary aluminum from the U.S.S.R.; in 1978, the GDR also traded in primary aluminum with Western countries. A contract was reportedly signed at the Leipzig Fall Fair in 1978 with Hungary's Chemolimpex enterprise for the delivery of a complete aluminum smelter to the GDR.

Production of alumina declined again in 1978 and 1979, and it was reported that the alumina plant at Lauta reached only 67% of its production capacity.

All of the GDR's bauxite is imported, coming mainly from Hungary and Yugoslavia and in 1978 from Greece as well.[9] In 1980, high-grade bauxite may be imported from Guyana; it would be the first high-grade bauxite imported from that country since 1975.[10]

The GDR signed a contract with the French company Cecim at the Leipzig Spring Fair in 1978 for the design and installation of an aluminum foil rolling mill at Merseburg.[11]

Antimony.—The GDR produces antimony at Antimonbergwerk Oberböhmsdorf. Located near Schleiz in Thuringen, this plant produces small amounts of antimony concentrate and metal. It appears, however, that the plant has some difficulty in finding sufficient supplies of raw materials.

Cadmium.—Official statistics on cadmium production are not reported, but 1978 and 1979 estimates remained at 20 tons, as has been estimated for each of the previous 5 years. In 1978, estimated consumption rose to 480 tons from 450 tons in 1977. The GDR's cadmium is derived primarily as a byproduct of the smelting of zinc and other nonferrous metals at two plants in Eisleben and Weide. Much of the domestic requirements for cadmium is met by imports from the U.S.S.R. During the period from October 1978 to September 1979, however, cadmium was also imported from Japan. Reportedly, the GDR was the largest importer of Japanese cadmium.[12]

Copper.—The GDR does not publish its copper production or import figures. In 1978 and 1979, estimated copper production declined; estimated consumption, however, was up to 118,000 tons in 1978 from 115,000 tons in 1977. Because of this, combined with domestic mine closures, copper imports increased significantly, continuing to come mainly from the U.S.S.R.[13]

The GDR's copper deposits are concentrated in the Mansfeld-Eisleben-Hettstedt area but are almost depleted. Reportedly, a longwall system was introduced in the Sangerhausen copper field that significantly reduced mining losses in 1978.[14]

The copper wire mill being built at Mansfeld was scheduled for completion in 1979. It is anticipated that wire will be cast directly from molten copper at this mill, thus eliminating intermediate processes such as the production of copper bars. The mill would be the first to employ this copper-casting and rod-rolling process in any centrally planned economy country.

Iron and Steel.—Production of crude steel in 1979 was up over the 1977 level. Production of iron ore fluctuated, while output of pig iron continued the decline begun in 1977. The per capita output of pig iron had been steadily rising, but in 1978 it dropped for the first time since 1970 to 152 kilograms from 157 kilograms in 1977. The GDR's iron ore reserves are almost depleted, and domestic production of steel and pig iron is inadequate to meet demand. This made the GDR dependent once again in 1978 and 1979 upon imports for a large share of its requirement of these commodities. Almost all of the iron ore and much of the scrap, pig iron, and rolled steel are imported from the U.S.S.R.

There are indications that the GDR's imports of metals were up significantly in 1979, coming primarily from the U.S.S.R., Czechoslovakia, and Poland. The GDR exports substantial quantities of semifinished and finished steel products.

According to some reports, of the more than 160,000 individuals working in the

GDR's ore mining, metallurgical, and potash industries, 130,000 are employed by the ferrous metallurgical industry (iron foundries and steelworks).

Over 75% of the GDR's steel production is from scrap. Starved of indigenous raw materials and faced by spiraling costs on the world market, the GDR has launched a massive press and radio campaign to explain the value of scrap metal, glass, etc., as secondary raw materials. Illustrative of the GDR's campaign to save valuable raw materials was a ruling by the East Berlin Ministry of Construction that forbids, in principle, the use of rolled steel products in aboveground construction, effective January 1, 1978. Exceptions to this ruling can be approved only by the Ministry. According to this ruling, concrete is to be used to a greater extent in structures instead of rolled steel.[15]

In 1978, an order was placed for a new heavy plate steel mill, VEB Stahl- und Walzwerk at Brandenburg, with the Austrian company Vöest-Alpine AG and the FRG firm Schloemann-Siemag. When completed, the mill is expected to produce 500,000 tons of steel plates annually. The order also includes a hot- and cold-dividing shear line. The total mill order is valued at the equivalent of US$267.7 million, and commissioning of the mill is scheduled for 1981 or 1982. The FRG's share of investment in this order is 25%. In return for this order, Austria plans to buy smelting technology from the GDR. The Brandenburg steelmaking plant is presently equipped with open hearths, and the rolling mills include a blooming mill, tube mill, wire rod mill, and 6,500-millimeter slab mill (annual capacity of the slab mill is 3 million tons). Future expansion plans include construction of an electric steelmaking shop with two Asea arc furnaces and two eight-strand Danieli continuous billet casters. The expansion may have been commissioned in 1979, and the shop is slated to have a capacity of 550,000 tons annually.[16]

Reportedly, the GDR's high-grade steel manufacturer VEB Edelstahlwerk (Freital) and the Soviet Institute of Electrothermal Plants jointly developed a 40-ton plasma furnace in 1978 that is especially designed for alloyed and high-alloy steels.

In 1978, the FRG firm Friedrich Krupp GmbH at Rheinhausen handed over for operation the new equipment it installed at the GDR's Wilhelm Florin steelworks and the rolling mill at Hennigsdorf. The new equipment is capable of producing 175,000 tons of electrosteel annually and reportedly cost the GDR DM120 million. The order was filled under a long-term agreement on economic and technical cooperation between Krupp and the GDR. The capacity of the Hennigsdorf steelworks rose to 1.2 million tons.

In 1978, the FRG firm Krupp Industrie- und Stahlbau AG, a subsidiary of Friedrich Krupp, handed over a complete foundry to the GDR firm Industrie Anlagenimport of East Berlin. The foundry, the result of 2 1/2 years of planning and construction, is located near Uckermünde on the Oder estuary. It is designed to produce 16,000 tons of pipe fittings annually and was built at a cost of DM120 million.

Negotiations were underway in 1978 between the GDR and a European consortium led by the Belgian steel firm Cockerill for construction of a completely new 850,000-ton-per-year medium-section rolling mill. It is reported that the GDR is giving priority to expansion of rolling mill capacities in its current 1976-80 5-year plan.[17]

Lead and Zinc.—The GDR's lead and zinc mines are old, and mining has almost ceased owing to ore depletion. The GDR's mine output data for lead and zinc have not been reported for a number of years. The VEB Buntmetall lead-zinc-silver complex at Freiberg, about 25 kilometers northeast of Karl-Marx-Stadt (formerly Chemnitz), is the largest in the GDR and uses imported concentrates in its production. The refined lead capacity is about 20,000 to 25,000 tons annually, of the Saxonia brand. About 15,000 to 22,000 tons of electrolytic slab zinc is produced annually at the same plant.

Most of the GDR's lead and zinc requirements are met through imports from the U.S.S.R. The U.S.S.R. ceased reporting its exports in 1975, in which year the GDR imported 47,000 tons of lead and 40,553 tons of zinc from the U.S.S.R. The estimated consumption of lead in 1978 was 95,000 tons. In addition to imports from the U.S.S.R., the GDR imported in 1978 about 3,400 tons of refined lead from Western countries and reexported 800 tons to these countries.

The GDR's estimated consumption of zinc increased in 1978 to 70,000 tons, a rising trend that has continued for at least the last 5 years. Imports of slab zinc from Western countries in 1978 decreased 86% from the record high of 15,700 tons in 1976, the first year of the current 5-year plan.

Nickel.—The GDR is a significant produc-

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er of primary nickel in Eastern Europe. Nickel consumption increased from 9,000 tons in 1974 to about 11,000 tons in 1978.

Over 70% of the GDR's nickel requirements are imported, mostly from the U.S.S.R. Hüttenwerk St. Egidien is the country's main nickel smelter. It is situated close to Glauchau, about 30 kilometers west of Karl-Marx-Stadt, and has a capacity of over 1,200 tons annually. The plant was built after World War II and smelts ore from the nearby Kuchschnappel surface mines in 60-ton furnaces capable of treating at least 100 tons of ore per day.

Another smelter, Hüttenwerk Aue, is situated about 35 kilometers southwest of Karl-Marx-Stadt and produces electrolytic nickel and nickel anodes. A third nickel smelter is Hüttenwerk Oberschlema; its products include nickel cubes, pellets, and salts. A fourth source of domestic nickel is thought to be Hüttenwerk Müldenhutten at Halsbrücke, about 25 kilometers northeast of Karl-Marx-Stadt, just north of Freiberg. The GDR's Kuchschnappel nickel deposits are almost depleted, but in 1978 a new surface mine was reported to have started operations near Freiberg.

Silver.—Production of silver in the GDR, down slightly since the start of the current 5-year plan, has been estimated to average 1.6 million troy ounces annually in the first 4 years of the plan. Because of increasing mining costs and diminishing domestic deposits, most of the GDR's silver requirements are met through imports, coming mostly from the United Kingdom. According to some reports, annual silver consumption had increased to over 16 million troy ounces.

Silver is produced in the GDR as a byproduct of other nonferrous operations. It is believed that almost all domestic production comes from the VEB Buntmetall lead-zinc-silver complex at Freiberg. About 25% of the GDR's domestic silver is reprocessed from secondary materials.

Tin.—In 1978 and 1979, tin mine output and metal production both went up owing to the start of operations in 1977 of a new mine and ore-processing plant at Altenberg and a new tin smelter at Freiberg. Tin and copper are the only significant metallic minerals mined in the GDR. Reportedly, tin production is to be raised 45% by 1980 over that of 1976, primarily through improvement of mining and production technologies.

Consumption of refined tin has risen steadily for the past 5 years to the current estimated level of 3,000 tons per year. Most of the domestic tin deficiency is made up through imports of tinplate from the U.S.S.R. Zinnhütte Freiberg, which is part of the Albert Funk Mining and Metallurgical Complex, uses tin concentrates from the Altenberg, Sadisdorf, and Ehrenfriedersdorf mines, together with 200 to 300 tons of imported concentrate. The older roaster and reverberatory furnaces of the plant use the Saiger (liquation) process for tin production assaying 99.6% to 99.8% tin and 0.03% arsenic, with some copper, lead, bismuth, and iron.

NONMETALS

Barite and Fluorite.—Estimated production of barite and fluorspar increased slightly in 1978 and 1979 and provided for domestic demand and some export. In 1978, barite was exported to Poland, and fluorspar was exported to Poland, Austria, and Norway. Barite and fluorite occur in the GDR as veins, fissure fillings, and replacement deposits in the Thuringian Forest and the Harz Mountains. Both minerals are processed at the Lengenfeld fluorite and barite plant in the southern part of the country.

Cement.—Production of cement continued to rise in 1978 and 1979. Cement imports, coming mostly from the U.S.S.R. with some from Poland, decreased slightly, while exports to Hungary and Yugoslavia increased during the 2-year period. The Karsdorf cement works, the largest in the GDR, began full production of new sulfate-resistant cement in 1978. In 1978, the GDR firm VEB Schermaschinenbau-Kombinat Ernst Thälmann (SKET) in Magdeburg was reportedly seeking licenses in the United States for its dry-process cement production method and the manufacture of equipment for cement clinker production. The process and equipment were developed by the engineering enterprise Zementanlagenbau in Donau. Licenses for the dry-process cement method and equipment have already been sold to Western European engineering firms.

It was reported that the cement works at Donau built a crusher in 1979 that is able to pulverize 160 tons of clinker per hour. The new crusher is 70 tons lighter and more energy efficient than existing ones, and plans are to export the crusher to Cuba, Bulgaria, Yugoslavia, and Syria.

Chalk.—The GDR is self-sufficient in chalk and exports much of its domestic production. Chalk continues to be mined on Rügen Island, Europe's largest chalk deposit, and is processed by VEB Kreidewerke Rügen near Sassnitz.

Clay and Sand.—The GDR has considerable deposits of silicate minerals such as quartz sand, kaolin (china clay), and other clays. From 1970 to 1975, the GDR increased its output of these raw materials 150%. To meet expanding domestic needs, the country plans to increase output of these silicate minerals at an even greater rate as part of the current 5-year plan. VEB Silikatrohstoff-Kombinat Kemmlitz manages the silicate mining industry. By some estimates, the combine employs a force of some 2,000 workers and in 1979 produced over 3.5 million tons of quartz sand, kaolin, and other clays.[18]

The GDR's current 5-year plan calls for an annual increase of 5% to 6% in the production of clay. The ceramics and glass industry meets almost 96% of its requirements from indigenous deposits. Approximately 3 million tons of fireproof and ceramic clays, kaolin, vitreous sand, and quartzite are extracted from as many as 36 surface and underground mines. Bentonite and kaolin are also exported and imported. The kaolin deposits near Bautzen are the richest in the GDR. The country's only blue clay deposit is surface mined at Grimmen, about 65 kilometers east of Rostock, to a depth of 20 meters, from a pit about 20 hectares in areal extent. About 850 cubic meters of clay is mined per day. Much of the clay is used as an insulating aggregate in the production of construction slabs.

According to W. Greiner-Petter, Minister of the Glass and Ceramics Industry, clay in the GDR has been surface mined for the last 100 years, but because of depletion, the depth of the surface mine operation will go to over 80 meters. This will necessitate the use of large overburden stripping equipment and machinery which until now has been used only by the lignite industry. Reportedly, the first such machine has been put into stripping operation at the Glassandwerk Hohenbocka vitreous sand quarry in the Cottbus area. Sand deposits of low iron content are still being mined in Lausitz and Magdeburg, and according to Dieter Noack, Director of VEB Silikatrohstoff-Kombinat Kemmlitz, studies are underway for converting these low-grade quartz sands into high-grade quartz sands with low iron content.

Fertilizer Materials.—In 1978 and 1979, total fertilizer production again registered an increase, surpassing 6 million tons in nutrient content in 1978. As in previous years, potassic fertilizer made up 72% of this production, nitrogenous fertilizers 19%, and phosphatic fertilizers 9%. The GDR imports large quantities of crude phosphate, mostly from the U.S.S.R., and some manufactured phosphatic fertilizers, mostly from the FRG. Nitrogenous and potassic fertilizers are also imported, but in smaller quantities. The GDR reexports some crude phosphate and some manufactured phosphatic, potassic, and nitrogenous fertilizers.

Nitrogenous.—Production of manufactured nitrogenous fertilizers has continued to increase slightly but steadily since 1973. The GDR imported nitrogenous fertilizers and exported some to various European countries, mostly to Hungary and the United Kingdom. Negotiations began in 1978 between Coppee Rust of the United Kingdom and the GDR for the modernization and refurbishment of an existing calcium ammonium nitrate plant at Schwedt. Reportedly, some equipment may have to be replaced owing to corrosion problems. In 1979, it was reported that the GDR planned a grass-roots nitrogenous fertilizer complex to be built by the French contractor Creusot-Loire. The plans call for construction of a new storage terminal at Rostock on the Baltic coast. The U.S.S.R. is to supply the 350,000 tons per year of ammonia to be used as feedstock in the new complex; the ammonia would be shipped 10 kilometers by a pipeline to the complex. The complex is to comprise units with capacities of 2,400 ton per day of nitric acid, 3,400 tons per day of calcium ammonium nitrate, 150 tons per day of porous ammonium nitrate, and 70 tons per day of crystalline ammonium nitrate. The cost of the terminal, pipeline, and fertilizer complex is set at about US$200 million. Construction was to begin in 1979, and commissioning is scheduled for the end of 1983. The GDR plans to furnish its own equipment for installation at the Rostock complex and to build a power station adjacent to the site without outside assistance.[19]

Phosphatic.—Production of phosphatic fertilizers picked up in 1978 and 1979 from the slight downward trend of the previous 3 years. The GDR continued to import large quantities of raw phosphate and apatite concentrate and smaller amounts of manufactured phosphatic fertilizer, but all in lesser quantities than in 1977. Imports of manufactured phosphatic fertilizer in 1978, for example, decreased about 27% from the previous year's level. The major portion of

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the raw phosphate is imported from the U.S.S.R. For the past several years, the GDR has also imported raw phosphate from Tunisia. In 1979, the GDR reportedly committed itself to purchasing even larger quantities of Tunisian phosphate on a long-term basis. These imports reflect the policy of the centrally planned economy countries to penetrate the Tunisian market by purchasing more phosphate in exchange for increased Tunisian purchases. The GDR has virtually no phosphatic raw materials, which accounts for the high level of imports. The GDR did, nevertheless, export some phosphatic fertilizers (both raw and manufactured) to some Eastern and Western European countries.

Potassic.—The GDR in 1978 and 1979 remained the world's third leading producer of potash (producing about 12% of the world total) and continued to increase production. The country also maintained its position as the second largest exporter of potash. Over 46% of the GDR's potassic fertilizer is exported to centrally planned economy countries, with exports to many other parts of the world as well. The GDR's exports show a continuous slight increase since the start of the current 5-year plan. Next to the U.S.S.R., the GDR is the main supplier of potassic fertilizer to Czechoslovakia, Hungary, and Poland.

With the Zielitz mine operating at full capacity and minor expansion at some of the older mines such as Thomas Müntzer, the GDR's potash industry should be able to produce 3.5 million to 3.8 million tons of K_2O by 1980. Thus, only minor expansion is expected in the last year of the current 5-year plan. Although recovering somewhat in 1979, domestic consumption of potash fell markedly in recent years and was lower both in 1977 (at 471,700 tons) and 1978 (at 569,000 tons) than in 1970 (at 613,900 tons).[20]

The GDR's identified potash reserves are estimated at 300 million to 900 million tons of K_2O, and total reserves are estimated at over 7 billion tons. The four potash enterprises are managed by VEB Kombinat Kali. Each enterprise is located at the site of a deposit being mined. All of the GDR's mines are underground, employing the room-and-pillar method. The following tabulation presents data on GDR's four potash enterprises and their capacities:[21]

Potash enterprise and mine location	Ore type and concentration (percent K_2O)	Depth of mine (meters)	Type of refinery	Product	Annual capacity (thousand metric tons K_2O)
Kalibetrieb Werra:					
Unterbreizbach	Carnallite (13-15)	800	Crystallization.	KCL and K_2SO_4.	320
Merkers	do	800	do	do	480
Dornoff	do	800	do	do	290
Total					1,090
Kalibetrieb Zielitz:					
Zielitz	Sylvinite (15)	700-800	Flotation	KCL	1,100
Kalibetrieb Süd-Harz:					
Rossleben	Hartsalz (14-15)	400-1,000	Flotation and crystallization.	KCL and K_2SO_4.	290
Sondershausen	Hartsalz (13)	400-1,000	do	do	190
Sollstedt	Hartsalz (12-13)	400-1,000	do	do	160
Menteroda/ Volkenroda.	Sylvinite (12-13)	400-1,000	do	do	130
Bleicherode	Hartsalz (13-14)	400-1,000	do	do	190
Bischofferode (Thomas Müntzer).	Hartsalz (12)	400-1,000	do	do	250
Total					1,210
Kali und Steinsalzbetrieb Saale:					
Teutschental	Kieserite and Hartsalz (7).	400-1,000	do	do	30
Grand total					3,430

In 1978 and 1979, the GDR continued to invest in expansion of its potash industry. The Zielitz potash enterprise in the Magdeburg area, for example, is planning an expansion at a cost of M120 million. The project was scheduled to begin in March 1979 and is scheduled for completion in spring of 1981. Under a contract with Industrieanlagen Import-Corporation, Kloeckner Industrieanlagen GmbH is to build a plant for production of granulated potash fertilizer. One of Kloeckner's partners in the project is to be Philipp Bros. of the United States.

MINERAL FUELS

The GDR is deficient in fossil fuels such as petroleum, natural gas, and hard coal, and thus is forced to import most of these. For cost-saving purposes, the GDR is utilizing as much of its single abundant energy source, lignite, as possible. Lignite, which is available domestically in abundance, accounts for two-thirds of domestic primary energy consumption. The GDR meets over 97% of its petroleum requirements from abroad, including about 90% from the U.S.S.R. The small domestic natural gas yield (about 8.5 billion cubic meters) is supplemented exclusively by imports from the U.S.S.R. The GDR has recently become an importer of metallurgical hard coal for its smelter industry. Overall, the dependence of the energy industry on foreign deliveries has increased steadily. To date, the most important supplier remains the U.S.S.R.

Electric energy in the GDR is generated from all existing sources, including coal, petroleum, gas, uranium, and hydropower. In 1979, just over 100 billion kilowatt-hours of electric energy was generated. The estimated current electric power capacity of the GDR is 18,500 megawatts. The GDR is planning to intensify its research into generation and utilization of solar energy for heating industrial and residential buildings, as well as other installations. The GDR is a high energy user, and officials are attempting to curb consumption of energy resources an average of 4%. New powerplants, however, are still being planned. Jeanschwalde, near Cottbus, for example, is the site of the next large powerplant which will utilize lignite from nearby surface mines. It is expected that this plant will require several years of construction and will employ up to 6,000 workers during construction.[22]

In 1979, the Ministry of Coal and Energy and the Price Office ordered increases of up to 3% in energy prices to go into effect in 1980. The increases were intended to encourage conservation and counter growing Soviet criticism that CMEA countries, including the GDR, are not doing enough to conserve energy. Price increases for electricity, oil, and natural and manufactured gas in 1980 are expected to mainly affect industrial users; consumer prices are to remain unchanged by increasing subsidies. Furthermore, according to official reports, the Ministry now has direct authority to issue directives to individual areas and districts on the economic use of energy, supplies of heat to centrally heated housing complexes, and supplies of solid fuels. The districts were ordered to build up sufficient fuel stocks to bridge any possible supply delays. In 1979, Klaus Siebold, Minister of Coal and Energy, was dismissed and replaced by Wolfgang Mitzinger. Siebold's replacement resulted from the collapse of energy supplies during the winter of 1978-79, allegedly caused by his inefficient management.[23]

Total estimated primary energy balances for 1978 and 1979 are shown in table 4.

Table 4.—German Democratic Republic: Primary energy balance for 1978 and 1979

(Million tons of standard coal equivalent[1])

Year	Total primary energy	Coal (lignite, brown, bituminous)	Crude oil and petroleum products	Natural and associated gas	Hydroelectric power	Nuclear power
1978:						
Production[2]	96.0	83.7	0.1	11.4	0.2	0.6
Imports	41.3	7.0	29.3	4.8	.2	--
Exports	.8	.7	--	--	.1	--
Apparent consumption	136.5	90.0	29.4	16.2	.3	.6
1979:						
Production[2]	96.5	84.2	.1	11.4	.2	.6
Imports	41.5	7.0	29.3	5.0	.2	--
Exports	.8	.7	--	--	.1	--
Apparent consumption	137.2	90.5	29.4	16.4	.3	.6

[1] 1 ton standard coal equivalent (SCE) = 7,000,000 kilocalories. Conversion factors used are: Bituminous coal, 1.0; lignite and brown coal, 0.33; crude oil, 1.47; natural gas, 1.33 (per thousand cubic meters); and hydroelectric and nuclear power, 0.123 (per thousand kilowatt-hours).

[2] Derived from table 1.

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Coal.—In 1978 and 1979, the GDR remained the world's third largest producer of lignite. In 1978, the GDR produced over 27% of the world's lignite, exceeding the Soviet's share. The GDR's VEB Schwermaschinenbaukombinat TAKRAF claimed to be the world's largest manufacturer of surface coal mining machinery. The equipment is used domestically for stripping over 1.1 billion cubic meters of overburden annually and is also exported to the U.S.S.R., Bulgaria, Czechoslovakia, Hungary, Poland, Romania, Yugoslavia, Austria, and Greece.[24]

No other country in the world is as dependent on lignite as an energy resource as the GDR. In 1978, over 81% of the country's electric energy was produced from lignite, extracted from 35 surface mines. In the foreign trade sector, the GDR exports both lignite and coal mining machinery. In order to provide itself a stable supply of energy to meet the increasing consumption, the GDR must produce at least 260 million tons of lignite in 1980. Increased production is expected to become more difficult and expensive, however, while the unit fuel value of the GDR's lignite is expected to decrease. More overburden has to be removed, mines are deeper, and coal seams are thinner than in the past; and these factors necessitate more and larger mining machinery for work in complex geological conditions. Nevertheless, lignite remains the GDR's most abundant and cheapest fuel. According to some official sources, the cost of lignite fuel at present is about half the cost of oil or natural gas.[25]

In the coming decades, lignite is expected to remain the main source of the GDR's primary energy. The amount of lignite mined is to be increased to nearly 280 million tons by 1990. By that time, however, about 5.5 cubic meters of overburden per ton of lignite would have to be removed, instead of the 3.5 to 4.0 cubic meters per ton that is presently removed. By that time, the heating capacity of some lignite is expected to decrease to below 2,000 kilocalories per kilogram, so that larger amounts of fuel would be necessary to produce 1 kilowatt of electric energy. By some estimates, however, remaining lignite reserves of the GDR will last only another 20 years.[26]

The GDR decided to increase purchases of coal and coke from the FRG in 1979 because deliveries of coal from Poland, the U.S.S.R., and Czechoslovakia were interrupted in 1978. The Ministry of Foreign Trade announced that this coal, intended primarily for industry, will be supplied from the Saarland and the Ruhr. The Saarbergwerke is expected to supply about 150,000 tons of coke and 200,000 tons of coal to the GDR in 1979.

As a result of a 1976 agreement between the GDR and the FRG, the GDR in 1978 commenced preparatory work on lignite deposits just southeast of Helmstedt in the FRG, where the lignite reserves are situated on both sides of the border. The GDR plans to open 6 to 10 new open pits, with a total annual capacity of about 160 million tons, to compensate for the anticipated closure of 21 older mines. There are plans to expand the capacities of five surface mines. In 1978, three new strip mines were planned for development near Delitzsch, just north of Leipzig, with a processing center to be located in Kreis. The Delitzsch-Kreis is intended to become a new coal and energy center in 1990, producing some 10% of all lignite and 5% of all electric energy in the GDR. Annual production from the three mines is estimated at 27 million tons, and the reserves are expected to last beyond the year 2000.

The Groitzscher Dreieck lignite mine, with an annual capacity of 5 million tons of lignite, began full operation in 1978. The Groitzscher mine is the fourth of several new surface mines due to go into production by 1980. It has reserves of about 200 million tons in an area of some 13 square kilometers. The Leipzig area accounts for about 25% of the GDR's lignite production.

Continuous operation began full swing in 1978 at the new surface lignite mine at Schlabendorf Sud, part of the Jugend lignite enterprise in the Cottbus district, with a planned output of 18 million tons in 1979. The mine is to supply the Lubbenau-Vetschau and other power stations and is the second of the new surface mines planned as part of the 1976-80 5-year plan. The mine uses two TAKRAF overburden conveyor bridges transferred from the depleted lignite mines of the Schlabendorf Nord and Seese areas.[27]

The largest surface lignite mine in the GDR was being developed in 1978 and 1979 near the Gross-Lieskow area as part of the Jänschwalde lignite complex. The thickness of the overburden is 50 meters, cleared by a 60-meter overburden conveyor bridge. The start of production is planned for 1981 at an annual rate of 15 million tons of lignite, eventually scheduled to increase to 20 million tons when the mine is fully developed.[28]

Natural Gas and Petroleum.—The year 1979 marked the completion of the Orenburg gas pipeline (also referred to as Alliance or Soyuz), the greatest joint construction project to date of the CMEA countries. The project agreement was signed in June 1974, and construction began in 1975 on the 2,750-kilometer pipeline. A cooperative construction effort was undertaken to build the Orenburg condensed-gas storage facility in the Urals and the gas pipeline from Orenburg to the Ukraine on the western border of the U.S.S.R. The GDR undertook construction of approximately 260 kilometers of the line with its own funds and workers. A delivery of 15.5 billion cubic meters of natural gas from the U.S.S.R. to the signatory countries was agreed, 2.8 billion cubic meters of which is to be received by the GDR.

The GDR uses Soviet natural gas in its chemical industry, in metallurgy, and in its glass and ceramics industry. The Orenburg gas is eventually expected to lead to a doubling of the GDR's natural gas imports. It is estimated that imports of Soviet natural gas in 1980 will reach an alltime high of 5.0 billion to 5.6 billion cubic meters.[29]

By some accounts, the GDR's apparent consumption of natural gas in 1978 exceeded 12 billion cubic meters, and reserves were calculated at 84 billion cubic meters (excluding probable and possible reserves).[30]

In addition to natural gas, the GDR also manufactures about 4 billion cubic meters of coal gas at the VEB Gaskombinat Schwarze Pumbe in the Cottbus district. The coal gas facility is also responsible for the operation of 7,000 kilometers of the GDR's gas pipeline network and together with its other facilities employs about 25,000 workers. The facility also receives Soviet gas through the Orenburg pipeline. Some of this gas is added to the coal gas together with imported propane and other components, but most is pumped into the national gas network. Reportedly, efforts are underway to change over East Berlin's gas supply from coal gas to natural gas.

The U.S.S.R. supplies up to 97% of the GDR's crude oil supplies. The GDR's 1980 imports of Soviet crude oil are set at 18 million tons.

A tentative agreement was reached between the GDR and the FRG in 1979 for the GDR to import 950,000 tons of crude oil annually from the FRG between 1980 and 1985, with a provision for an increase of up to 1.14 million tons. The GDR, on the other hand, will ship to the FRG—especially to West Berlin—about 1.79 million tons of petroleum products, with a provision for increases of up to 2.2 million tons.[31]

In order to find new oil reserves off the Baltic coast and the surrounding area, an organization known as Petrobaltic was recently formed by the GDR, the U.S.S.R., and Poland. A detailed survey of the area has been completed by the Leningrad Institute of Geological Petroleum Exploration, and a letter of intent has been signed by the Soviet and Polish Governments for joint construction of a drilling vessel for use in the Baltic. The GDR is very much interested in this venture as it may represent its best hopes of discovering oil resources of any size. Actual drilling is expected to start in the 1980's.[32]

In 1979, the Rostock oil port was modernized, allowing the docking of larger tankers and the unloading of oil in less than one-third the time previously required. According to reports, 41,000 to 45,000 tons of oil can be pumped into storage in less than 24 hours. The deepened 10-kilometer channel and port are able to handle ships with a load capacity of up to 45,000 tons.[33]

Nuclear Power.—In 1979, there were four nuclear plants in operation in the GDR. Two 440-megawatt units were under construction in the Magdeburg District at Stendal and are scheduled for completion in 1980. The construction and technical know-how were supplied by the U.S.S.R., as in all previous nuclear projects. The third block of the Bruno Leuschner nuclear powerplant near Greifswald began operation in 1978 at the projected output of 440 megawatts. With the completion of the third block, the Bruno Leuschner plant reached a total capacity of 1,320 megawatts and became the GDR's third largest powerplant.

According to some estimates, the GDR's nuclear operating capacity in 1978 and 1979 was 2,180 megawatts, and the 1980 capacity was set at 3,560 megawatts, or over 5% of the nation's present electric energy production. By some accounts, the first breeder reactor in the GDR is to become operational around 1985.

According to estimates, the GDR's annual production of uranium may be as much as 12,000 to 18,000 tons, or three times the 1970 output. Some reports calculate the GDR's assured uranium resources at 60,000 tons and additional uranium resources at 200,000 to 500,000 tons. Uranium is export-

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ed to the U.S.S.R.

Taking into account the depletion and unavailability of domestic mineral fuels and the rising cost of imports, the GDR has placed the development of atomic energy in the forefront of its energy plans. By 1980, 10% of the GDR's electricity may well be generated from nuclear energy, and by the year 2000, nuclear energy is expected to provide 40% of the nation's electricity.

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[1] Physical scientist, Branch of Foreign Data.

[2] The GDR's mark (M) is thought to be currently convertible to U.S. dollars at the rate of approximately M2 to M3.18 = US$1.00.

[3] DIW Wochenbericht (Weekly Report), West Berlin. V. 46, No. 6, Feb. 8, 1979, pp. 55-57.

[4] An organization of 10 centrally planned economy countries involved in economic cooperation and coordination, comprising the following countries in 1979: Bulgaria, Cuba, Czechoslovakia, the GDR, Hungary, Mongolia, Poland, Romania, the U.S.S.R., and Vietnam. Yugoslavia obtained permanent observer status in 1965.

[5] Kernenergie (Nuclear Energy), East Berlin. No. 9, September 1979, pp. 293-298.

AW DDR-Aussenwirtschaft (Foreign Trade), East Berlin. V. 7, No. 40, Oct. 3, 1979, pp. 1-2.

[6] AW DDR-Aussenwirtschaft (Foreign Trade), East Berlin. V. 6, No. 37, Sept. 13, 1978, pp. 1-2.

Source: DIW Wochenbericht (Weekly Report), West Berlin. V. 46, No. 10, Mar. 8, 1979, pp. 111-116.

[7] The Deutsche mark (DM) is currently convertible to U.S. dollars at the rate of DM1.8672 = US$1.00.

[8] Metal Bulletin Monthly, London. May 1979, p. 83.

[9] Mining Journal, London. Jan. 13, 1978, p. 28.

[10] Mining Journal, London. Mar. 30, 1979, pp. 249-250.
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[11] Aluminum, Düsseldorf. V. 54, No. 8, August 1978, p. 496.

[12] Eastwest Markets, New York. Nov. 13, 1978.
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[13] World Metal Statistics, London. V. 32, No. 10, Oct. 18, 1979.

[14] Mining Annual Review, London. 1979, pp. 586-588.

[15] IWE-Tagesdienst (Daily Service), Bonn. No. 9-10, Jan. 12-13, 1978, p. 3.

[16] Iron and Steel Works of the World. 1978, 7th ed., pp. 265-267.
San Francisco Chronicle, San Francisco. Oct. 5, 1978.
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[17] Handelsblatt (Trade Sheets), Düsseldorf. Apr. 4, 1978, p. 11.
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[18] Industrial Minerals, London. August 1979, pp. 10-11.

[19] European Chemical News, London. May 5, 1978, p. 28.
Chemical Age, London. Dec. 14, 1979, pp. 55-56.

[20] Phosphorus & Potassium, London. No. 103, September-October 1979, pp. 26-29.

[21] Derived from: World Potash Survey, Washington. World Bank Staff Working Paper No. 293, September 1978.

[22] Berliner Zeitung (Berlin News), East Berlin. Feb. 3-4, 1979, p. 9.

[23] Die Zeit (Time), Hamburg. No. 28, July 6, 1979, p. 25.

[24] GDR Foreign Trade, East Berlin. No. 18, 1979, p. 11.

[25] Der Tagesspiegel (Daily Mirror), West Berlin. May 10, 1979, p. 3.

[26] IWE Wirtschaftsdienst (Domestic Economy Service), Bonn. V. 20, No. 10, Mar. 15, 1979, p. 3.

[27] Mining Magazine, London. Feb. 1978, p. 145.

[28] Bergbau, Zeitschrift für Bergbau und Energiewirtschaft (Mining, Mining and Energy Journal), West Berlin. January 1978, p. 34.

[29] AW DDR-Aussenwirtschaft (Foreign Trade), East Berlin. V. 7, No. 6, February 1979, pp. 1-2.
Hungarian Foreign Trade, Budapest. No. 1, 1979.

[30] Petroleum Economist, London. August 1979, p. 314.
National Zeitung (National News), East Berlin. May 12, 1978, p. 2.

[31] Informationen (Information), Bonn. No. 14, September 1979, pp. 9-11.

[32] Petroleum Economist, London. December 1978, p. 506.

[33] Neues Deutschland (The New Germany), East Berlin. Jan. 11, 1979, p. 5.
The Guardian, London. Jan. 9, 1978, p. 14.

The Mineral Industry of the Federal Republic of Germany

By Joseph B. Huvos[1]

After a slow start, the economy of the Federal Republic of Germany picked up momentum during the second quarter of 1978, and real growth for the year reached 3.5% and 4.2% for 1979, while unemployment decreased to about 3.8%. The country's gross national product (GNP) by yearend 1979 was about $729 billion,[2] [3] to which the country's minerals industry contributed about 13%.

The Federal Republic of Germany remained one of the world's major processors and consumers of minerals, most of which had to be imported except for coal, potash, and salt, of which there was a plentiful supply in the country. The securing of the supply of raw materials remained one of the Federal Republic of Germany's chief objectives. Contribution of the individual sectors of the mining and minerals processing industry in 1978-79 is shown in the tabulation below:

	Contribution to gross national product (million dollars)[1]		Average 1979 employment (thousand persons)
	1978	1979	
Coal mining	10,029	12,423	205
Stones and earths	13,329	15,761	193
Iron and steel	21,574	25,344	288
Nonferrous metals	8,846	11,541	76
Chemical including petroleum	59,470	70,150	560
Total	113,248	135,219	1,322

[1] Does not include value added tax.

Source: Adapted from Statistisches Budesamt, Wiesbaden. Wirtschaft und Statistik, No. 2, 1980, p. 75.

PRODUCTION

Notable events in the Federal Republic of Germany's mineral industry included a 45-day strike in the steel industry, various decisions by several Federal Republic of Germany steel companies in favor of ongoing projects aimed at modernizing plants and equipment in the steel industry, and granting of a loan by the European Communities to Thyssen AG for installing environmental equipment. In the coal industry, coal subsidies were raised from 4.5% to 6.2%, and production started at the Hambach Lignite Mine. In the nuclear power industry, one new nuclear powerplant was commissioned, and the Federal Republic of Germany Government decided in 1978 to build both a nuclear fuel enrichment plant and a nuclear fuel reprocessing and waste storage plant. In the petroleum industry, a deal for a $414 million exchange of assets between the British Petroleum Co. (BP) and VEBA AG and the country's strategic petroleum reserve law were both implemented.

Production of mineral commodities in 1976-79 is shown in table 1.

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Table 1.—Federal Republic of Germany: Production of mineral commodities

(Met..ic tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Bauxite, gross weight	221	28	280	NA
Alumina thousand tons	1,333	1,454	1,410	1,400
Metal:				
Primary do	697	742	740	[1]741
Secondary:				
Alloyed do	305	347	358	NA
Unalloyed do	42	45	47	NA
Bismuth:[2]				
Ore and concentrate	11	11	9	10
Metal, smelter	500	700	600	[1]661
Cadmium metal, smelter	1,275	1,336	1,182	1,170
Cobalt metal, smelter	([3])	--	--	--
Copper:				
Mine output, metal content	1,613	1,210	821	900
Metal:				
Blister and anodes:				
Primary	193,695	178,267	165,800	227,900
Secondary	50,805	58,407	55,700	60,400
Refined, including secondary:				
Electrolytic	[r]285,581	340,725	245,438	[1]228,522
Fire refined	[r]161,000	99,431	158,000	148,000
Total	446,581	440,156	403,438	[1]376,522
Gold:				
Mine output, metal content troy ounces	2,456	2,392	2,119	2,400
Metal, including secondary do	346,874	319,803	336,264	NA
Iron and Steel:				
Iron ore and concentrate thousand tons	2,256	2,470	1,600	[1]1,644
Metal:				
Pig iron and blast-furnace ferroalloys do	[r]31,528	28,959	29,861	[1]34,584
Electric-furnace ferroalloys do	229	210	139	130
Steel ingots and castings do	42,415	38,985	41,253	[1]46,040
Semimanufactures do	29,793	28,758	30,198	NA
Lead:				
Mine output, metal content	31,675	31,105	23,181	32,000
Metal, unalloyed:				
Primary	[r]100,965	105,150	105,212	130,000
Secondary	[r]18,178	204,467	199,829	203,000
Magnesium metal including alloys:				
Unwrought (secondary only)	500	600	[e]600	600
Castings	177,340	204,467	16,260	[1]15,899
Mercury (secondary only) 76-pound flasks	3,191	[e]3,200	2,437	2,500
Molybdenum metal	227	NA	NA	NA
Nickel metal, including secondary[5]	130	91	901	1,070
Platinum troy ounces	2,253	[e]4,820	2,572	NA
Silver:				
Mine output, metal content thousand troy ounces	1,026	1,061	799	800
Metal, including secondary do	23,497	18,004	18,085	[1]16,291
Tin metal, including secondary	[r]1,449	3,940	3,241	3,000
Tungsten metal	1,563	[e]1,400	[e]1,500	NA
Zinc:				
Mine output, metal content	115,344	114,152	97,405	90,000
Metal, unwrought, unalloyed:				
Primary	253,359	335,127	298,679	[1]333,065
Secondary	21,395	19,653	18,157	[1]21,858
NONMETALS				
Barite	262,287	265,593	168,586	200,000
Bromine	4,154	3,736	3,893	4,500
Cement and clinker:				
Cement thousand tons	33,281	32,168	33,959	37,000
Clinker do	2,136	1,245	1,344	NA
Clays:				
Fire clay (exclusive of klebsand) do	5,056	5,276	5,224	NA
Kaolin, marketable do	[r]441,732	499,636	521,000	NA
Bleaching do	625	642	621	NA
Other (schieferton) do	108	129	128	NA
Corundum, artificial	83,196	93,646	96,737	[1]102,212
Diatomite and similar earth, marketable	52,948	49,457	47,600	50,000
Feldspar, marketable	419,976	393,793	365,590	390,000
Fluorspar, marketable:				
Acid grade[6]	57,789	75,375	68,150	NA
Metallurgical grade[6]	6,421	8,375	7,592	NA
Total	64,210	83,750	75,742	85,000

See footnotes at end of table.

Table 1.—Federal Republic of Germany: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978ᵖ	1979ᵉ
NONMETALS —Continued				
Graphite:				
Crude	19,101	16,653	12,763	12,000
Marketable⁴	ʳ14,026	13,456	11,927	NA
Gypsum and anhydrite, marketable ... thousand tons	ʳ2,099,814	2,217,878	2,238,355	2,300,000
Lime, hydrated, and quicklime including dead-burned dolomite ... do.	9,426	8,770	8,990	9,000
Nitrogen, N content of ammonia ... thousand tons	1,863	1,989	1,955	2,090
Phosphates:				
Phosphate rock (including apatite), gross weight ... do.	86	80	--	--
Thomas slag-based fertilizer, P_2O_5 content ... do.	167	134	150	¹145
Pigments, mineral, natural	ʳ22,840	26,421	21,475	25,000
Potash, K_2O equivalent:				
Crude, marketable ... thousand tons	70	76	72	NA
Chemically processed ... do.	1,966	2,265	2,398	2,400
Total ... do.	2,036	2,341	2,470	2,400
Pumice:				
Crude and washed ... do.	3,689	3,137	3,552	2,640
Marketable ... do.	2,197	1,749	2,087	2,100
Pyrite, marketable concentrate, gross weight ... do.	523	531	502	590
Quartz, quartzite, glass sand:				
Quartzite ... do.	372	425	411	¹426
Quartz sand, ground ... do.	418	407	421	¹454
Quartz sand, unground and glass sand ... do.	6,111	6,737	7,026	¹7,417
Salt, marketable:				
Rock ... do.	6,375	7,131	6,846	6,800
Marine and other ... do.	4,942	5,192	5,812	5,900
Sodium compounds:				
Sodium carbonate	1,363,526	1,350,543	1,229,722	1,200,000
Sodium sulfate	256,677	242,247	211,000	210,000
Stone, sand and gravel, n.e.s.:				
Dimension stone ... thousand cubic meters	194	215	326	¹333
Limestone, industrial ... thousand tons	52,615	48,953	50,956	¹54,521
Crushed and broken stone ... do.	102,215	110,718	118,096	¹109,147
Slate³ ... do.	2	2	3	¹3
Basalt lava and lava sand ... do.	5,922	6,623	7,047	NA
Calcite ... do.	4	9	12	NA
Grinding stone ... cubic meters	48	63	238	¹71
Tuff ... thousand tons	3	2	3	NA
Sand and gravel ... do.	155,010	170,425	184,786	¹196,637
Sulfur:				
S content of pyrite ... do.	233	235	221	260
Byproduct of:				
Metallurgy ... do.	390	385	380	380
Natural gas ... do.	460	631	650	650
Petroleum ... do.	119	186	190	190
Unspecified ... do.	161	165	160	160
Total ... do.	1,363	1,602	1,601	1,640
Talc, including talc schist ... do.	18	16	15	16
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	292,322	301,678	297,509	¹340,629
Coal:				
Anthracite ... thousand tons	6,628	6,067	6,942	¹7,018
Bituminous coal ... do.	82,641	78,773	76,994	¹79,301
Lignite ... do.	134,493	122,920	123,559	¹130,579
Total ... do.	223,762	207,760	207,495	¹216,898
Coke:				
Metallurgical ... do.	31,951	27,497	25,455	¹26,501
Gashouse ... do.	971	809	782	¹937
Total ... do.	32,922	28,306	26,237	¹27,438
Fuel briquets:				
Of anthracite and bituminous coal ... do.	1,357	1,805	1,453	¹1,673
Of lignite ... do.	4,390	4,104	3,889	¹4,782

See footnotes at end of table.

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Table 1.—Federal Republic of Germany: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued				
Gas:				
Manufactured (excluding that from petroleum refineries):[6]				
Blast furnace million cubic feet	201,399	174,312	179,857	[1]212,629
Coke oven[7] do	263,517	223,294	205,848	[1]214,224
Other do	76,915	70,735	72,818	[1]52,760
Total do	541,831	468,341	458,523	[1]479,713
Natural:				
Gross do	665,537	678,565	726,898	NA
Marketable do	653,050	637,578	707,156	NA
Peat:				
Agricultural use thousand tons	1,707	1,911	2,047	2,100
Fuel use do	227	221	228	250
Petroleum:				
Crude thousand 42-gallon barrels	39,902	39,021	36,541	NA
Refinery products:				
Gasoline, aviation and motor do	147,439	123,479	127,069	[1]182,800
Jet fuel do	10,799	10,099	10,620	[1]10,346
Kerosine do	378	456	334	[1]523
Distillate fuel oil do	301,929	293,903	292,020	[1]345,621
Residual fuel oil do	158,397	143,004	160,047	[1]146,333
Lubricants do	9,081	6,763	6,653	[1]9,660
Other:				
Liquefied petroleum gas do	32,680	38,741	37,932	[1]36,669
Bitumen do	23,063	22,421	22,856	[1]23,756
Unspecified do	98,534	86,999	[e]76,555	[1]97,846
Refinery fuel and losses do	38,230	46,253	54,362	[1]90,807
Total do	820,530	772,118	788,458	[1]953,260

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1]Reported figure.

[2]Revised to none.

[3]Primary nickel and nickel contained in ferronickel, Monel metal, and nickel oxide directly used by the steel industry.

[4]Produced in part from imported crude graphite.

[5]Exclusive of slate recovered from mine dumps.

[6]Natural gas equivalent is 240 kilocalories per cubic foot (8,400 kilocalories per cubic meter).

[7]Includes water gas and generator gas from coke ovens.

TRADE

In 1978, the total Federal Republic of Germany trade surplus amounted to $21.9 billion, of which the trade surplus with the United States was $1.4 billion, double that of the previous year, and the trade surplus with members of the Organization of Petroleum Exporting Countries tripled to $2.75 billion. In 1979 the trade surplus shrank significantly. The members of the European Communities remained the Federal Republic of Germany's principal trading partners. Total mineral trade of the Federal Republic of Germany in 1977-78 is shown in tables 2-3.

Table 2.—Federal Republic of Germany: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite	9,327	12,260	Belgium-Luxembourg 6,868; France 3,656.
Alumina	231,518	344,606	Canada 111,740; Spain 80,912; U.S.S.R. 25,637.
Aluminum hydroxide	118,543	120,544	Sweden 36,148; Netherlands 21,505; France 16,432.
Metal including alloys:			
Scrap	48,092	52,982	Italy 17,010; Netherlands 15,245; France 14,216.
Unwrought	199,136	271,610	France 62,690; Italy 60,986; Netherlands 48,861.
Semimanufactures	307,838	343,982	France 62,046; Netherlands 36,445; United Kingdom 32,639.
Antimony:			
Ore and concentrate	132	--	
Metal including alloys, all forms	216	20	United States 1.
Arsenic trioxide, pentoxide, acids	58	NA	
Beryllium metal including alloys, all forms kilograms	1	15	NA.
Bismuth metal including alloys, all forms	462	517	United Kingdom 166; United States 153; Denmark 41.
Cadmium rhenium and metals including alloys, all forms	274	313	Iran 6.
Chromium:			
Chromite	3,931	3,212	Canada 1,002; France 605; Austria 354.
Oxide and hydroxide	11,709	47,668	NA.
Metal including alloys, all forms	63	125	Belgium-Luxembourg 43; Japan 33; Italy 17.
Cobalt:			
Oxide and hydroxide	41	86	Netherlands 31; Belgium-Luxembourg 15; France 10.
Metal including alloys, all forms	340	796	Romania 21; Switzerland 16; Belgium-Luxembourg 10.
Columbium and tantalum metals including alloys, all forms:			
Columbium kilograms	11,074	19,109	Switzerland 707; France 201; Poland 199.
Tantalum do	60,924	47,122	France 2,295; Yugoslavia 191; Hungary 176.
Copper:			
Ore and concentrate	--	(1)	NA.
Matte	338	300	Belgium-Luxembourg 240.
Copper sulfate	1,593	1,861	NA.
Metal including alloys:			
Scrap	46,340	58,956	Italy 18,871; France 9,004; Austria 6,377.
Unwrought:			
Smelter	32,364	29,589	United Kingdom 25,817; Belgium-Luxembourg 3,324.
Refined:			
Alloyed	7,336	8,064	Italy 1,753; France 1,231; Belgium-Luxembourg 1,050.
Unalloyed	66,954	112,695	Belgium-Luxembourg 21,799; Italy 16,944; India 15,482.
Master alloys	1,058	1,283	Belgium-Luxembourg 687; France 394.
Semimanufactures	248,214	319,822	Netherlands 40,704; France 34,450; Belgium-Luxembourg 31,475.
Gallium metal including alloys, all forms kilograms	11,200	5,600	Japan 1,400; United States 1,300; Netherlands 900.
Germanium metal including alloys, all forms do	200	400	All to United States.
Gold metal:			
Ash and waste do	1,863	607	NA.
Scrap and sweepings troy ounces	228	1,403	France 1,050; Switzerland 303.
Unwrought thousand troy ounces	569	1,433	Switzerland 548; Thailand 187; Italy 136.
Semimanufactures troy ounces	193,188	194,531	United Kingdom 44,379; Israel 37,047; Japan 24,796.
Iron and steel:			
Ore and concentrate	3,292	5,855	Austria 2,682; Belgium-Luxembourg 539; Greece 358.
Roasted pyrite	244,788	184,218	Belgium-Luxembourg 103,855; Austria 42,096; Switzerland 16,395.
Metal:			
Scrap thousand tons	2,481	2,765	Italy 2,017; Belgium-Luxembourg 358; France 95.
Pig iron, including cast iron do	704	736	France 370; Poland 114; Italy 94.
Sponge iron, powder, shot do	46	57	France 13; United Kingdom 13; Switzerland 9.
Spiegeleisen do	520	2,716	United States 1,065; Egypt 500; Italy 475.

See footnotes at end of table.

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Table 2.—Federal Republic of Germany: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Ferroalloys:			
Ferrochrome	36,426	31,419	France 9,5[illegible]; Italy 6,343; United States 4,870.
Ferromanganese	74,037	49,391	Belgium-Luxembourg 14,147; Italy 13,506; France 6,020.
Ferronickel	54	8	NA.
Ferrosilicon	23,244	25,818	France 5,114; Netherlands 1,408; Belgium-Luxembourg 1,066.
Ferrosilicochrome	1,630	1,623	Italy 1,158; Belgium-Luxembourg 312; Austria 83.
Ferrosilicomanganese	2,215	742	France 446; Italy 130.
Other	15,970	13,436	Romania 1,771; United States 1,700; Poland 1,257.
Steel, primary forms thousand tons	2,599	3,214	France 698; Italy 272; Algeria 205.
Semimanufactures:			
Bars, rods, angles, shapes, sections do.	3,255	3,725	France 717; Netherlands 477; Iran 400; United States 279.
Universals, plates, sheets do.	5,393	6,345	U.S.S.R. 1,233; United States 1,070; France 635.
Hoop and strip do.	1,095	1,221	U.S.S.R. 185; France 147; Netherlands 145.
Rails and accessories do.	150	182	Italy 51; Netherlands 26; United States 14; Switzerland 12.
Wire do.	287	292	France 54; Netherlands 41; Belgium-Luxembourg 31.
Tubes, pipes, fittings do.	2,791	3,691	U.S.S.R. 955; China, mainland, 515; Netherlands 423; Mexico 205.
Castings and forgings, rough do.	110	113	Belgium-Luxembourg 19; France 15; Netherlands 12.
Lead:			
Ore and concentrate	6,639	10	NA.
Oxides	11,154	11,508	Netherlands 5,844; Sweden 950; Pakistan 822.
Metal including alloys:			
Scrap	18,564	16,801	Netherlands 6,656; Italy 5,226; Denmark 2,253.
Unwrought	105,402	106,810	Italy 35,362; France 13,951; United States 10,893.
Semimanufactures	8,006	11,626	Denmark 1,634; Switzerland 1,368; Belgium-Luxembourg 920.
Lithium:			
Ore and concentrate	1,307	NA	
Oxides and hydroxides	625	557	France 169; Italy 126; United Kingdom 92.
Metal, all forms	13	16	Switzerland 10; France 4; India 1.
Magnesium:			
Oxides, hydroxides, peroxides	4,495	NA	
Metal including alloys:			
Scrap	2,572	2,620	Italy 1,311; Netherlands 937; United States 156.
Unwrought	200	179	Austria 115; France 40.
Semimanufactures	330	409	Republic of South Africa 74; France 60; Netherlands 51.
Manganese:			
Ore and concentrate	3,008	2,088	France 715; Netherlands 510; Austria 327.
Oxides	3,961	3,027	Austria 91; France 31.
Metal	100	31	Italy 5; France 2.
Mercury 76-pound flasks	1,694	2,205	Switzerland 325; Egypt 232.
Molybdenum:			
Ore and concentrate	1,174	1,117	Netherlands 321; United States 234; Belgium-Luxembourg 190.
Metal including alloys, all forms	216	237	Japan 7; France 3; Romania 3.
Nickel metal including alloys:			
Scrap	8,025	7,150	Sweden 5,192; Austria 726; United Kingdom 343.
Unwrought	6,815	5,175	France 2,406; Netherlands 964; Finland 496.
Semimanufactures	16,288	6,882	United States 2,094; Belgium-Luxembourg 930; United Kingdom 810.
Platinum-group metals:			
Platinum:			
Ash and waste kilograms	111,359	25,301	Belgium-Luxembourg 25,300.
Scrap and sweepings troy ounces	684	2,726	Spain 1,619; Netherlands 890.
Metal including alloys, all forms do.	694,271	706,462	Italy 140,104; Netherlands 98,524; Switzerland 88,044.
Palladium metal including alloys, all forms do.	190,092	110,918	Switzerland 37,412; Netherlands 32,174; Brazil 7,964.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Silicon metal	1,153	1,678	France 705; Austria 372; United Kingdom 105.
Silver:			
Ash and waste kilograms	73,136	82,342	Belgium-Luxembourg 58,706; France 23,697; Switzerland 479.
Scrap and sweepings thousand troy ounces	414	251	Switzerland 146.
Metal including alloys, all forms do	34,195	39,192	Italy 5,910; Austria 5,167; Switzerland 2,446; France 2,326.
Tin:			
Ore and concentrate	149	(1)	
Oxides	397	NA	
Metal including alloys:			
Scrap	120	88	Netherlands 84.
Unwrought	4,372	4,813	Netherlands 3,460; France 590; Austria 172.
Semimanufactures	796	741	Austria 80; Switzerland 63.
Titanium:			
Ore and concentrate	2,361	6,195	Bulgaria 1,820; France 1,041; Switzerland 743.
Oxides	38,992	48,073	United States 8,966; Italy 5,551; Netherlands 3,074.
Metal including alloys, all forms	1,643	1,904	United Kingdom 667; Italy 350; United States 274.
Tungsten:			
Ore and concentrate	172	87	U.S.S.R. 46; France 28; Netherlands 9.
Metal including alloys, all forms	572	542	Sweden 14; France 13; Austria 7.
Uranium and thorium:			
Oxides, including rare-earth oxides	1,558	1,212	United States 752; Japan 194; France 143.
Metals including alloys, all forms kilograms	7,500	6,700	United Kingdom 4,800.
Vanadium metal including alloys, all forms	1	55	United Kingdom 50; Japan 4.
Zinc:			
Ore and concentrate	76,823	72,495	Belgium-Luxembourg 43,523; Netherlands 21,640; United Kingdom 1,075.
Oxide	9,918	12,033	NA.
Metal including alloys:			
Scrap	11,236	7,254	Netherlands 4,849; Belgium-Luxembourg 744; France 715.
Blue powder	6,782	6,539	Netherlands 1,597; Romania 1,301; United Kingdom 982.
Unwrought	131,436	87,538	United States 25,164; Netherlands 10,462; United Kingdom 9,830.
Semimanufactures	12,913	13,526	France 3,415; Netherlands 2,694; Austria 1,296.
Zirconium:			
Ore and concentrate	7,100	6,865	France 1,844; Netherlands 890; Bulgaria 769.
Metal including alloys, all forms	113	97	United States 29; France 23; Japan 20.
Other:			
Ores and concentrates:			
Of columbium, tantalum, vanadium	940	1,040	United States 969; Netherlands 61; Austria 5.
Of base metals, n.e.s	3	5	NA.
Ash and residue containing nonferrous metals	148,834	168,640	Belgium-Luxembourg 62,912; Netherlands 42,385; United States 13,705.
Oxides, hydroxides, peroxides of metals	13,385	17,106	Netherlands 575; Norway 400; Italy 351.
Metals including alloys, all forms:			
Metalloids:			
Arsenic and tellurium	1	2	United States 1.
Selenium and phosphorus and elemental sodium and potassium	11,447	7,629	NA.
Alkali, alkaline-earth, rare-earth metals	462	264	Italy 12; Japan 2.
Pyrophoric alloys	58	6,247	NA.
Base metals including alloys, all forms, n.e.s	425	615	France 299; Japan 140; Sweden 72.
NONMETALS			
Abrasives:			
Natural:			
Pumice, emery, natural corundum, etc	490,063	1,619,101	Netherlands 1,545,725; Belgium-Luxembourg 64,102.
Dust and powder of precious and semiprecious stones kilograms	392	385	Brazil 158; Austria 81; Greece 74.
Grinding and polishing wheels and stones	12,841	11,440	Netherlands 1,792; Switzerland 1,718; France 1,526.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Abrasives —Continued			
Artificial:			
Corundum	46,942	45,234	Italy 9,713; Austria 5,474; Netherlands 4,161.
Silicon carbide	22,531	24,444	NA.
Asbestos	45,551	43,314	NA.
Barite and witherite	32,761	38,178	France 8,194; Romania 6,120; Austria 5,140.
Boron materials:			
Crude natural borates	16,378	11,966	Italy 3,770; Sweden 3,266; Belgium-Luxembourg 2,115.
Oxide, acid, borates, perborates	49,169	46,648	Switzerland 24,424.
Bromine	194	112	Italy 89.
Cement thousand tons	2,217	2,644	Netherlands 1,527; Nigeria 348; Iran 138.
Chalk	16,343	18,064	Denmark 5,844; Sweden 4,939; Finland 3,525.
Clays and clay products (including all refractory brick):			
Crude:			
Andalusite and kyanite	5,546	6,199	Italy 2,113; Austria 1,004; Portugal 780.
Bentonite	30,494	25,014	France 12,161; Netherlands 4,405; Sweden 2,473.
Ceramic clay	637,704	691,412	Italy 184,146; Belgium-Luxembourg 176,660; Netherlands 164,511.
Chamotte	38,370	36,473	Netherlands 16,965; Switzerland 5,459; Italy 4,162.
Dinas earth	14,716	39,401	France 13,928; Italy 5,780; Netherlands 3,869.
Fire clay	217,127	294,199	Netherlands 99,151; Italy 80,532; Belgium-Luxembourg 53,805.
Fuller's earth	582	1,086	France 640; Norway 77.
Kaolin	101,120	102,599	Italy 26,442; Austria 21,382; Belgium-Luxembourg 15,132.
Other	234,781	218,441	Netherlands 183,266; France 10,171; Italy 9,417.
Products:			
Refractory (including nonclay brick)	605,757	622,672	France 104,767; Belgium-Luxembourg 85,080; Netherlands 42,589.
Nonrefractory	861,194	943,170	Netherlands 249,477; France 220,730; Belgium-Luxembourg 188,452.
Cryolite and chiolite kilograms	97	17	NA.
Diamond:			
Crude, set or strung thousand carats	129	146	Switzerland 52; Belgium-Luxembourg 37; Netherlands 22.
Industrial do	220	360	Ireland 201; Switzerland 35; Japan 25.
Diatomite and other infusorial earth	3,909	3,999	Netherlands 1,486; United Kingdom 805; Austria 358.
Feldspar, leucite, nepheline, nepheline syenite	20,886	18,759	France 6,649; Belgium-Luxembourg 2,371; Italy 2,208.
Fertilizer materials:			
Crude:			
Phosphatic	1,280	1,230	NA.
Potassic	32,795	32,279	Belgium-Luxembourg 15,581; United Kingdom 13,376; Netherlands 3,054.
Manufactured:			
Nitrogenous thousand tons	1,082	1,232	Belgium-Luxembourg 443; Brazil 112; India 75.
Phosphatic do	27	46	Austria 13; United Kingdom 10; Brazil 7.
Potassic do	1,755	2,378	Belgium-Luxembourg 662; India 189; United Kingdom 148.
Other, including mixed do	80	962	Belgium-Luxembourg 196; Austria 107; France 101.
Ammonia, anhydrous do	317	221	Denmark 90; France 38; Belgium-Luxembourg 32.
Fluorspar	10,979	14,789	Austria 7,870; Netherlands 1,881; Yugoslavia 1,358.
Graphite, natural	7,483	7,927	Italy 2,157; United States 1,186; France 1,034.
Gypsum and plasters	334,250	355,983	Netherlands 226,301; Belgium-Luxembourg 38,503; Switzerland 31,785.
Iodine	14	31	France 15; Yugoslavia 4.
Lime	549,427	580,035	Netherlands 494,780; France 36,575; Switzerland 19,680.
Magnesite	11,278	21,693	United Kingdom 6,784; France 4,574; Netherlands 2,872.
Mica:			
Crude, including splittings and waste	758	777	Switzerland 290; Austria 116; Turkey 50.
Worked, including agglomerated splittings	260	427	United Kingdom 103; Yugoslavia 25; United States 16.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Pigments, mineral:			
Natural, crude	2,184	NA	
Iron oxides, processed	144,428	158,898	United States 22,897; France 19,633; United Kingdom 14,732.
Precious and semiprecious stones, except diamond:			
Natural kilograms	258,538	166,716	Switzerland 17,092; Italy 16,809; United States 16,312.
Manufactured do.	14,439	19,728	Japan 11,259; Netherlands 2,881; United States 1,805.
Pyrite, gross weight	636	1,361	NA.
Salt thousand tons	2,022	1,935	Belgium-Luxembourg 1,177; Sweden 317; Denmark 105.
Sodium and potassium compounds, n.e.s.:			
Caustic soda do.	1,131	1,176	Netherlands 196; Canada 55; United States 46.
Caustic potash and sodic and potassic peroxides do.	20	15	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	4,078	3,286	Austria 1,267.
Slate	12,685	11,170	Netherlands 4,006; Belgium-Luxembourg 3,807; Denmark 2,667.
Other	544,661	405,232	Netherlands 298,789; Switzerland 92,474; Italy 3,542.
Worked:			
Slate	1,068	1,616	Belgium-Luxembourg 892; Netherlands 426.
Paving stone and flagstone	23,027	24,284	Denmark 13,000; Belgium-Luxembourg 5,432; Netherlands 4,503.
Other	22,012	22,310	Belgium-Luxembourg 5,816; Austria 5,413; Netherlands 3,399.
Dolomite, chiefly refractory grade	224,989	230,987	France 103,704; Netherlands 89,300; Belgium-Luxembourg 25,812.
Gravel and crushed rock thousand tons	12,341	9,646	Netherlands 7,576; Switzerland 844; Belgium-Luxembourg 718.
Limestone, except dimension	52,456	66,562	Brazil 25,000; Netherlands 22,220; Belgium-Luxembourg 13,596.
Quartz and quartzite	112,302	161,466	Belgium-Luxembourg 85,917; Netherlands 22,952; Austria 13,313.
Sand, excluding metal bearing thousand tons	7,793	8,350	Netherlands 6,858; Belgium-Luxembourg 1,007; Austria 146.
Sulfates, natural: Magnesium sulfate (kieserite)	520,821	536,386	Norway 86,305; Singapore 71,385; France 63,887.
Sulfur:			
Elemental:			
Other than colloidal	341,928	304,693	Netherlands 119,155; Denmark 56,870; Austria 50,245.
Colloidal	2,496	1,568	Republic of South Africa 219; United Kingdom 174; Spain 170.
Sulfur dioxide	12,608	NA	
Sulfuric acid, including oleum	647,073	625,406	Belgium-Luxembourg 148,009; Netherlands 129,405; Spain 69,838.
Talc, steatite, soapstone, pyrophyllite	7,056	7,949	Yugoslavia 2,373; Denmark 1,817; Belgium-Luxembourg 798.
Other:			
Crude:			
Meerschaum, amber, jet kilograms	(1)	NA	
Pottery, broken	29,232	31,184	Netherlands 14,375; Switzerland 4,900; Austria 4,832.
Pozzolana and Santorin earth	15,698	NA	
Vermiculite, perlite, chlorite	1,078	2,767	Belgium-Luxembourg 1,248.
Other thousand tons	1,691	1,657	Netherlands 1,490; France 112; Belgium-Luxembourg 22.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture do.	2,878	2,993	Netherlands 2,875; France 69; Belgium-Luxembourg 41.
Slag and ash, n.e.s do.	566	715	Netherlands 594; France 83; Switzerland 14.
Oxides and hydroxides of strontium and barium	2,540	2,547	United States 797; France 719; Belgium-Luxembourg 343.

See footnotes at end of table.

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Table 2.—Federal Republic of Germany: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,765	1,941	Netherlands 661; Austria 417; Belgium-Luxembourg 340.
Carbon black and gas carbon:			
Carbon black	98,072	94,688	France 22,506; Austria 13,076; Belgium-Luxembourg 12,666.
Gas carbon	95	NA	
Coal and briquets:			
Anthracite and bituminous coal thousand tons	14,287	18,656	France 6,594; Belgium-Luxembourg 4,320; Italy 2,512.
Briquets of anthracite and bituminous coal do	267	382	France 208; Belgium-Luxembourg 99; Austria 31.
Lignite and lignite briquets do	465	509	France 174; Austria 133; Netherlands 71.
Coke and semicoke do	6,283	9,124	Belgium-Luxembourg 2,077; France 1,498; Netherlands 378.
Hydrogen and other rare gases	23,623	23,030	Italy 11,786; France 3,812; Austria 2,505.
Peat, including peat briquets and litter	466,795	494,921	Netherlands 306,463; Switzerland 58,863; France 53,758.
Petroleum:			
Crude 42-gallon barrels	238	224	NA.
Refinery products:			
Gasoline, motor do	3,799	[2]14,467	France 4,756; Netherlands 2,229; United Kingdom 2,112.
Kerosine and white spirit do	9,656	9,238	Ship stores 8,556; Switzerland 404; Netherlands 68; Czechoslovakia 47.
Distillate fuel oil do	7,185	6,204	Ship stores 1,841; France 1,182; Switzerland 883; Denmark 671.
Residual fuel oil do	20,799	20,772	Ship stores 9,158; Austria 3,007; France 1,712; Denmark 1,694.
Lubricants do	3,045	2,953	Belgium-Luxembourg 455; United States 375; United Kingdom 327.
Other:			
Mineral jelly and wax do	1,166	1,234	Ship stores 126; Italy 103; Netherlands 100; Austria 70.
Liquefied petroleum gas do	18,346	71,413	Netherlands 854; Belgium-Luxembourg 628; United Kingdom 554.
Unspecified do	14,812	1,325	Netherlands 587; Belgium-Luxembourg 168; France 129.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand tons	163,801	NA	

NA Not available.

[1] Less than 1/2 unit.

[2] Includes light oils, etc.

Table 3.—Federal Republic of Germany: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite thousand tons	4,090	3,614	Australia 1,950; Guinea 1,086; Sierra Leone 300.
Alumina	494,918	486,069	Australia 286,011; Italy 131,790; Surinam 31,519.
Aluminum hydroxide	2,099	2,080	United States 1,303; France 350.
Metal including alloys:			
Scrap	128,757	187,345	Netherlands 47,382; Austria 19,474; United States 11,303.
Unwrought	420,511	410,258	Norway 169,377; United Kingdom 43,800; Netherlands 40,539.
Semimanufactures	278,025	204,892	France 57,481; Netherlands 33,702; Belgium-Luxembourg 31,513.
Antimony:			
Ore and concentrate	2,578	3,040	Turkey 800; Chile 516; Republic of South Africa 459.
Metal including alloys, all forms	761	748	Belgium-Luxembourg 283; China, mainland, 200; Spain 40.
Arsenic trioxide, pentoxide acids	619	--	
Beryllium metal including alloys, all forms kilograms	794	815	United States 754.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Bismuth metal including alloys, all forms	160	112	Mexico 19; United Kingdom 14; Belgium-Luxembourg 10.
Cadmium metal including alloys, all forms	988	994	Belgium-Luxembourg 281; Japan 251; Canada 147.
Chromium:			
Chromite	415,593	371,738	Republic of South Africa 244,259; U.S.S.R. 46,593; Iran 23,561.
Oxide and hydroxide	1,243	1,453	U.S.S.R. 1,205; Poland 105; United Kingdom 90.
Metal including alloys, all forms	400	698	Belgium-Luxembourg 257; France 105; Netherlands 100.
Cobalt:			
Oxide and hydroxide	320	603	Belgium-Luxembourg 336; France 84; United Kingdom 82.
Metal including alloys, all forms	2,091	2,059	Zaire 808; Belgium-Luxembourg 605; France 203.
Columbium and tantalum metals including alloys, all forms:			
Columbium kilograms	3,877	10,743	United States 10,219.
Tantalum do	218,979	251,247	United States 187,775; United Kingdom 19,927; Japan 17,911.
Copper:			
Ore and concentrate	576,307	531,355	Papua New Guinea 238,998; Norway 68,430; Chile 66,395.
Matte	6,837	7,561	United Kingdom 2,758; Australia 2,512; Brazil 1,085.
Copper sulfate	8,232	8,575	France 2,781; Belgium-Luxembourg 2,684; U.S.S.R. 1,641.
Metal including alloys:			
Scrap	109,940	137,562	France 41,335; Netherlands 22,900; United Kingdom 17,149.
Unwrought:			
Smelter	118,921	109,225	Chile 43,774; Republic of South Africa 41,099; Zaire 8,060.
Refined:			
Alloyed	47,651	46,399	United Kingdom 11,666; Poland 5,764; Romania 5,428.
Unalloyed	440,276	428,794	Chile 106,818; Poland 72,381; Zambia 52,535.
Master alloys	1,652	1,551	United Kingdom 781; Belgium-Luxembourg 620.
Semimanufactures	156,291	163,940	Belgium-Luxembourg 61,302; France 37,114; Italy 18,892.
Gallium metal including alloys, all forms kilograms	2,700	1,700	Belgium-Luxembourg 600; Canada 400; United States 200.
Gold metal:			
Ash and waste do	45,715	55,310	Switzerland 22,095; Norway 9,844; United Kingdom 6,580.
Scrap and sweepings thousand troy ounces	1,188	816	Switzerland 314; Belgium-Luxembourg 170; Sweden 93.
Unwrought do	3,533	3,600	Switzerland 1,652; U.S.S.R. 1,089; Belgium-Luxembourg 230.
Semimanufactures do	50	61	Republic of South Africa 16; Switzerland 15; France 12.
Hafnium metal including alloys, all forms kilograms	40	20	NA.
Iron and steel:			
Ore and concentrate thousand tons	39,749	42,133	Brazil 11,132; Liberia 7,045; Sweden 5,727.
Roasted pyrite do	822	533	Spain 290; Belgium-Luxembourg 154; Portugal 43.
Metal:			
Scrap do	1,423	1,548	Netherlands 671; United Kingdom 218; Belgium-Luxembourg 212.
Pig iron, including cast iron do	311	293	Brazil 112; Canada 57; Norway 19.
Sponge iron, powder, shot do	38	45	France 18; Sweden 14; United Kingdom 6.
Spiegeleisen	41	37	NA.
Ferroalloys:			
Ferrochrome thousand tons	129	194	Republic of South Africa 104; Sweden 38; Finland 18.
Ferromanganese do	158	160	Norway 54; France 45; Spain 17.
Ferronickel do	39	61	Greece 49; New Caledonia 6; Dominican Republic 4.
Ferrosilicon do	141	159	Norway 68; France 40; Spain 16.
Ferrosilicochrome do	19	6	Sweden 3.
Ferrosilicomanganese do	69	101	Norway 48; Czechoslovakia 16; Spain 14.

See footnotes at end of table.

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Table 3.—Federal Republic of Germany: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Ferroalloys —Continued			
Other thousand tons	18	17	France 5; Belgium-Luxembourg 4; United Kingdom 2.
Steel, primary forms do	2,226	2,571	Belgium-Luxembourg 659; Netherlands 470; Austria 245.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	3,519	4,020	Italy 1,086; Belgium-Luxembourg 1,006; France 459.
Universals, plates, sheets do	3,886	3,684	Belgium-Luxembourg 1,126; France 653; Austria 319.
Hoop and strip do	563	623	Belgium-Luxembourg 239; France 166; Netherlands 77.
Rails and accessories do	29	34	Netherlands 21; Belgium-Luxembourg 5; Sweden 2.
Wire do	220	236	Belgium-Luxembourg 88; France 47; Italy 18.
Tubes, pipes, fittings do	670	811	Italy 203; France 130; Netherlands 112.
Castings and forgings, rough do	30	36	France 6; Netherlands 6; Poland 5; Hungary 4.
Lead:			
Ore and concentrate	195,020	170,055	Sweden 46,244; Canada 40,718; Peru 16,432.
Oxides	8,471	6,455	France 1,781; Belgium-Luxembourg 1,691; Austria 431.
Metal including alloys:			
Scrap	50,538	45,621	Netherlands 11,908; United States 9,556; France 9,406.
Unwrought	144,819	131,102	United Kingdom 31,695; Sweden 24,162; Belgium-Luxembourg 21,696.
Semimanufactures	3,012	2,822	Belgium-Luxembourg 1,516; Yugoslavia 834; France 131.
Lithium:			
Ore and concentrate	5,662	--	
Oxides and hydroxides	726	469	United States 188; U.S.S.R. 136.
Metal, all forms	18	17	U.S.S.R. 13; United States 4.
Magnesium:			
Oxides, hydroxides, peroxides	5,640	--	
Metal including alloys:			
Scrap	1,174	825	Austria 175; Netherlands 149; Denmark 130.
Unwrought	27,659	29,244	Norway 12,264; United States 7,036; Italy 4,729.
Semimanufactures	484	359	United States 139; Republic of South Africa 74; France 37.
Manganese:			
Ore and concentrate thousand tons	453	673	Republic of South Africa 488; Australia 74; Congo 45.
Oxides	2,727	2,625	Belgium-Luxembourg 1,681; Greece 357; Japan 235.
Metal	4,824	5,438	Republic of South Africa 2,055; Netherlands 1,875; United States 686.
Mercury 76-pound flasks	7,092	12,592	Algeria 3,623; Spain 2,813; Italy 2,628.
Molybdenum:			
Ore and concentrate	17,987	19,203	United States 10,030; Netherlands 2,416; Chile 2,307.
Metal including alloys, all forms	533	638	Austria 357; United States 132; France 48.
Nickel:			
Ore and concentrate	--	10	NA.
Matte, speiss, similar materials	16,136	16,464	Australia 8,753; Canada 4,993; Cuba 2,329.
Metal including alloys:			
Scrap	4,636	4,002	France 1,011; Netherlands 598; United States 390.
Unwrought	36,421	38,880	U.S.S.R. 6,939; Republic of South Africa 6,605; Norway 5,910.
Semimanufactures	5,202	5,280	France 1,862; United Kingdom 1,254; Belgium-Luxembourg 752.
Platinum-group metals:			
Platinum:			
Ash and waste kilograms	94,201	43,928	Italy 10,867; Romania 10,361; France 8,976.
Scrap and sweepings thousand troy ounces	109	148	United States 55; Belgium-Luxembourg 17; Netherlands 17.
Metal including alloys, all forms do	463	368	U.S.S.R. 116; United Kingdom 75; United States 54.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Platinum-group metals —Continued			
Palladium metal including alloys, all forms thousand troy ounces	431	431	United Kingdom 188; United States 80; Republic of South Africa 64.
Rare-earth metals:			
Oxides and other compounds	1,017	977	United States 292; United Kingdom 249; France 248.
Metals including alloys	155	110	NA.
Silicon metal including alloys, all forms	45,176	49,570	France 14,789; Norway 13,181; Republic of South Africa 4,663.
Silver:			
Ash and waste kilograms	399,242	506,382	United States 342,684; Sweden 40,218; Austria 33,650.
Scrap and sweepings thousand troy ounces	6,228	5,043	Mexico 2,375; United Kingdom 961; France 463.
Metal including alloys, all forms do	53,497	43,904	Switzerland 7,510; United Kingdom 7,427; Sweden 4,208.
Tin:			
Ore and concentrate	6,282	7,989	United Kingdom 3,429; Republic of South Africa 2,689; Bolivia 1,434.
Oxides	30	--	
Metal including alloys:			
Scrap	534	624	Netherlands 237; Switzerland 128; France 42.
Unwrought	15,619	15,481	Thailand 5,922; Indonesia 5,194; Malaysia 1,808.
Semimanufactures	1,495	1,572	Netherlands 1,452; United Kingdom 56.
Titanium:			
Ore and concentrate	599,361	519,562	Norway 335,215; Canada 121,557; Australia 35,069.
Oxides	21,570	17,586	Belgium-Luxembourg 8,145; United Kingdom 3,008; France 2,330.
Metal including alloys, all forms	2,284	3,871	Japan 2,242; U.S.S.R. 616; United Kingdom 401.
Tungsten:			
Ore and concentrate	2,980	3,422	China, mainland, 1,009; France 734; Australia 474.
Metal including alloys, all forms	924	1,149	United Kingdom 448; Austria 318; Republic of Korea 102.
Uranium and thorium:			
Ores and concentrates	21	--	
Oxides	20	229	France 65.
Metals including alloys, all forms	4	16	United Kingdom 12; France 2.
Vanadium:			
Oxides, hydroxides, pentoxides	1,324	1,850	Austria 374; United States 215; United Kingdom 19.
Metal including alloys, all forms	19	27	All from United States.
Zinc:			
Ore and concentrate	562,456	498,930	Canada 198,651; Sweden 65,101; Mexico 59,350.
Oxide and peroxide	6,823	6,673	France 2,858; Netherlands 1,898; Italy 577.
Metal including alloys:			
Scrap	4,859	9,637	Denmark 2,001; United States 1,788; France 1,184.
Blue powder	10,064	11,676	Belgium-Luxembourg 9,656; Netherlands 1,125; Norway 631.
Unwrought	137,942	152,294	Belgium-Luxembourg 72,468; Netherlands 28,990; Norway 11,901.
Semimanufactures	16,716	23,227	France 4,921; Netherlands 2,255; Yugoslavia 1,547.
Zirconium:			
Ore and concentrate	29,456	36,817	Australia 26,490; Republic of South Africa 5,927; United States 1,923.
Metal including alloys, all forms	362	348	United States 239; France 93; United Kingdom 5.
Other:			
Ores and concentrates:			
Of columbium, tantalum, vanadium	1,557	870	Brazil 598; Nigeria 127; United States 33.
Of base metals, n.e.s	5,476	2,836	Australia 2,465; Austria 94; Italy 37.
Ash and residue containing nonferrous metals	285,865	302,408	Canada 81,278; Belgium-Luxembourg 24,009; United Kingdom 22,690.
Oxides, hydroxides, peroxides of metals	6,517	5,869	Belgium-Luxembourg 1,604; France 1,383; United Kingdom 848.
Metals including alloys, all forms:			
Metalloids:			
Arsenic and tellurium	40	56	Sweden 24; U.S.S.R. 20; Japan 9.
Selenium and phosphorus	27,434	30,234	NA.
Alkali and alkaline-earth metals	729	212	France 146; United Kingdom 30; Canada 16.

See footnotes at end of table.

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Table 3.—Federal Republic of Germany: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Other —Continued			
Metals including alloys, all forms —Continued			
Pyrophoric alloys	44	--	
Base metals including alloys, all forms, n.e.s	568	680	Sweden 307; United States 148; United Kingdom 61.
NONMETALS			
Abrasives:			
Natural:			
Pumice, emery, natural corundum, etc	43,384	43,787	Greece 36,221; Italy 3,036; United States 1,727.
Dust and powder of precious and semiprecious stone kilograms	1,859	1,856	United States 996; Ireland 626; Switzerland 110.
Grinding and polishing wheels and stones	6,351	7,210	Austria 1,741; Spain 1,322; Italy 905.
Artificial:			
Corundum	29,659	33,587	Netherlands 12,035; Hungary 5,757; Austria 3,771.
Silicon carbide	61,946	61,884	Norway 11,249; Italy 4,114; Poland 2,982.
Asbestos	399,278	345,817	Canada 260,536; U.S.S.R. 32,400; Republic of South Africa 26,220.
Barite and witherite	175,356	196,465	France 73,117; China, mainland, 61,576; Spain 29,007.
Boron materials:			
Crude natural borates	126,770	124,564	United States 76,603; Turkey 45,116.
Oxide, acid, borates, perborates	79,334	76,929	Belgium-Luxembourg 28,865; United States 14,798; France 14,153.
Bromine	2,205	1,871	Israel 1,381; United Kingdom 185; United States 152.
Cement thousand tons	936	1,193	Belgium-Luxembourg 460; France 400; Netherlands 163.
Chalk	83,458	89,658	France 76,436; Belgium-Luxembourg 11,439; Sweden 1,254.
Clays and clay products (including all refractory brick):			
Crude:			
Andalusite and kyanite	54,322	57,258	United States 35,218; Republic of South Africa 8,753; India 4,212.
Bentonite	77,526	45,879	Greece 17,895; United States 16,619; Italy 2,674.
Ceramic clay	108,102	96,548	Netherlands 32,032; France 31,975; United Kingdom 16,829.
Chamotte	50,222	70,037	Czechoslovakia 36,434; France 20,848; Spain 2,965.
Dinas earth	6,468	4,964	Belgium-Luxembourg 4,702.
Fire clay	118,031	123,230	France 43,622; Czechoslovakia 35,711; United States 8,756.
Fuller's earth	16,360	6,785	United States 4,994; Spain 1,336; Netherlands 431.
Kaolin	679,510	716,891	United Kingdom 422,080; United States 111,479; Czechoslovakia 106,274.
Other	136,773	168,149	Czechoslovakia 46,568; France 44,322; Netherlands 32,323.
Products:			
Refractory (including nonclay brick) thousand tons	209	204	Austria 57; Czechoslovakia 28; France 21.
Nonrefractory do	1,405	1,560	Italy 597; Netherlands 523; France 164.
Cryolite and chiolite	2,819	1,244	Greenland 844; Denmark 324.
Diamond:			
Crude:			
Not set or strung thousand carats	26	3	NA.
Other do	711	678	Belgium-Luxembourg 325; Israel 171; U.S.S.R. 76.
Industrial do	933	1,165	Republic of South Africa 492; Belgium-Luxembourg 368; United Kingdom 79.
Diatomite and other infusorial earth	46,813	39,100	Denmark 22,822; United States 7,774; France 7,172.
Feldspar, leucite, nepheline, nepheline syenite	111,879	126,080	Norway 92,524; Italy 14,417; France 9,211.
Fertilizer materials:			
Crude:			
Nitrogenous	1,460	867	Chile 784.
Phosphatic thousand tons	2,694	2,441	United States 1,355; Morocco 411; U.S.S.R. 217.
Manufactured:			
Nitrogenous do	1,466	1,319	Belgium-Luxembourg 458; Netherlands 264; Austria 186.
Phosphatic do	915	785	Belgium-Luxembourg 634; Tunisia 42; France 26.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Fertilizer materials —Continued			
Manufactured —Continued			
Potassic thousand tons	83	94	France 83; Belgium-Luxembourg 6; Sweden 4.
Other, including mixed do	664	840	Belgium-Luxembourg 239; Austria 179; France 109.
Ammonia, anhydrous do	130	107	Austria 46; France 39; Netherlands 16.
Fluorspar	206,708	240,385	Spain 42,487; Republic of South Africa 28,109; Morocco 17,645.
Graphite, natural	29,369	28,583	Austria 6,877; China, mainland, 3,968; Norway 2,807.
Gypsum and plasters	345,286	374,263	France 197,647; Austria 170,015.
Iodine	704	791	Japan 417; Chile 365.
Lime	143,262	111,191	France 90,984; Denmark 10,655; Belgium-Luxembourg 4,380.
Magnesite	336,260	322,409	Greece 111,843; Austria 36,260; Italy 29,256.
Mica:			
Crude, including splittings and waste	8,122	9,729	India 2,723; Argentina 1,878; China, mainland, 900.
Worked, including agglomerated splittings	556	579	France 242; Belgium-Luxembourg 199; Spain 45.
Pigments, mineral:			
Natural, crude	2,475	--	
Iron oxides, processed	4,232	5,499	Netherlands 2,067; France 888; Belgium-Luxembourg 594.
Precious and semiprecious stones, except diamond:			
Natural kilograms	1,409,794	1,479,756	Brazil 828,518; United States 120,405; Republic of South Africa 109,831.
Manufactured do	27,790	22,220	Switzerland 11,605; Japan 4,629; United States 2,357.
Pyrite, gross weight	154,291	116,669	U.S.S.R. 77,063; Yugoslavia 23,696; Spain 13,503.
Salt	795,845	700,421	Netherlands 490,673; France 118,144; Italy 65,112.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	166,134	200,812	Belgium-Luxembourg 39,384; Poland 33,993; Switzerland 10,224.
Caustic potash and potassic peroxides	674	2,868	Spain 1,190; Belgium-Luxembourg 825; Sweden 245.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	137,396	148,547	Austria 62,839; Italy 38,010; Portugal 13,099.
Slate	20,172	22,968	United Kingdom 6,408; Portugal 5,535; France 5,463.
Other	294,191	287,620	Denmark 51,434; Austria 39,664; Italy 38,199.
Worked:			
Paving stones flagstone, related materials	132,102	157,442	Portugal 67,976; Italy 45,545; Romania 12,945.
Slate	12,984	16,340	Spain 10,207; France 1,702; Italy 1,319.
Other	488,098	493,064	Italy 435,136; Switzerland 12,359; Spain 9,785.
Dolomite, chiefly refractory grade	617,665	735,085	Belgium-Luxembourg 647,429; Austria 21,974; Spain 19,900.
Gravel and crushed rock thousand tons	12,561	12,962	France 7,304; Denmark 1,749; Norway 723.
Limestone, except dimension do	1,510	1,505	Austria 901; Belgium-Luxembourg 214; Sweden 182.
Quartz and quartzite	81,112	77,561	Netherlands 19,753; Sweden 13,170; Belgium-Luxembourg 12,017.
Sand, excluding metal bearing thousand tons	2,961	3,328	France 2,437; Netherlands 578; Belgium-Luxembourg 153.
Sulfur:			
Elemental:			
Other than colloidal	419,352	385,843	Poland 215,550; Canada 82,684; United States 58,899.
Colloidal	548	572	France 503.
Sulfur dioxide	7,361	--	
Sulfuric acid, including oleum	59,271	82,942	Finland 19,135; France 13,236; Switzerland 9,664.
Talc, steatite, soapstone, pyrophyllite	113,164	127,524	Austria 44,192; France 23,543; Italy 19,366.
Vermiculite, chlorite, perlite	98,643	105,478	Greece 80,473; Republic of South Africa 12,429; Hungary 9,217.

See footnotes at end of table.

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Table 3.—Federal Republic of Germany: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Other:			
Crude:			
Meerschaum, amber, jet	27,593	NA	
Pottery, broken	73,574	64,087	Netherlands 15,162; France 13,463; Czechoslovakia 9,680.
Pozzolans and Santorin earth	45	NA	
Other	550,584	728,184	France 219,670; United Kingdom 165,457; Norway 115,838.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture thousand tons	3,983	1,674	France 748; Belgium-Luxembourg 726; United Kingdom 68.
Slag and ash, n.e.s do.	212	300	France 146; Belgium-Luxembourg 65; United Kingdom 23.
Oxides and hydroxides of strontium and barium	963	732	France 280; U.S.S.R. 153.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	14,536	18,603	Trinidad and Tobago 11,899; United States 6,590.
Carbon black	49,063	48,757	Netherlands 15,818; France 15,538; U.S.S.R. 5,728.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	6,353	6,564	Poland 2,042; Republic of South Africa 1,108; Austrialia 763.
Briquets of anthracite and bituminous coal do.	47	--	
Lignite and lignite briquets do.	1,615	1,474	Czechoslovakia 1,469; Austria 5.
Coke and semicoke do.	922	925	United States 325; Netherlands 149; United Kingdom 130.
Hydrogen and other rare gases	18,473	18,260	Netherlands 9,837; Belgium-Luxembourg 6,610; France 800.
Peat and peat briquets	30,442	53,024	U.S.S.R. 36,527; Netherlands 8,215; Poland 6,749.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	696,534	681,339	Iran 123,975; Libya 111,471; Saudi Arabia 107,176.
Refinery products:			
Gasoline, motor do.	32,351	[1]102,008	Netherlands 44,992; Belgium-Luxembourg 11,798; Italy 6,900.
Kerosine and white spirit do.	15,334	21,632	Netherlands 10,812; Libya 5,383; Belgium-Luxembourg 2,814.
Distillate fuel oil do.	147,111	167,977	Netherlands 63,514; U.S.S.R. 29,460; France 14,569.
Residual fuel oil do.	30,163	40,200	Netherlands 19,440; Belgium-Luxembourg 5,160; U.S.S.R. 3,836.
Lubricants do.	2,029	2,025	France 541; United Kingdom 346; Italy 277.
Other:			
Mineral jelly and wax do.	1,112	1,108	Netherlands 269; France 139; United Kingdom 65.
Liquefied petroleum gas do.	340,236	396,901	France 1,054; Netherlands 869; Hungary 477.
Unspecified do.	59,374	328,816	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand tons	1,477	NA	

NA Not available.

[1] Includes light oils, etc.

COMMODITY REVIEW

METALS

Aluminum.—In November 1978, Gebrüder Giulini GmbH applied for bankruptcy. The company's 48,000-ton-per-year Ludwigshafen reduction plant was to remain temporarily in operation for the next 6 months, while the State of Rheinland-Pfalz provided $500,000 to keep the plant operating. In 1979 the Aluminium Co. of Canada Ltd. (ALCAN) purchased the company for $12.2 million.

The Federal Republic of Germany smelter output was near capacity in 1979, unchanged in comparison with that of the previous year. The Federal Republic of Germany's aluminum reduction plant capacity remainded about 762,000 tons per year in 10 plants operated by 6 companies. Four of these same companies controlled five alumina plants with a total capacity of 1,730,000 tons per year. Some alumina and all the bauxite used in the country's aluminum industry was imported.

Chromium.—Thyssen Edelstahlwerke AG, the special steel subsidiary of Thyssen AG, called on the Federal Republic of Germany Government to finance a stockpile of chrome, equivalent to the country's 2-year consumption, to guard against a possible short fall in supplies from South Africa.

Iron Ore.—The Federal Republic of Germany was, in 1978, the world's second largest importer of iron ore, with imports of about 45 million tons, or 94% of the iron ores used. In 1977, the Federal Republic of Germany's major iron ore suppliers were Brazil (26%), Liberia (17%), Australia (13%), Sweden (12%), and Canada (11%). In 1979, the situation was basically unchanged. Decline of the Federal Republic of Germany's domestic iron ore production continued during the period. Four domestic companies operated six iron ore mines. Average iron content of the Federal Republic of Germany iron ore output was less than 30%. In the 1980's, the Federal Republic of Germany plans to increase its overseas iron ore imports to about 55 million tons per year, an increase of about 10 million tons. Cooperative ventures concluded with Liberia and Brazil have helped to secure present supply, and it is expected that to secure future supplies, about $600 to $700 million will have to be invested in similar foreign ventures.

Iron and Steel.—About 100,000 workers out of a total work force of 208,000 in the Federal Republic of Germany's steel industry went on strike or were locked out of their jobs for 45 days beginning November 28, 1978. Affected were 19 steel plants in the Ruhr area and in the cities of Bremen and Osnabrück. In particular the following companies and plants were struck: Thyssen AG; Hochofenwerk Hamborn, Werk Beeckerwerth, head office in Düsseldorf, and Werk Meiderich; Mannesmann Hüttenwerke, Duisburg; Hoesch Hüttenwerke AG, Westfalenhütte; Friedrich Krupp Hüttenwerke AG Düsseldorf-Bernrath; Stahlwerke Krupp-Südwestfalen; and Mannesmann Röhrenwerke AG, Brakwede. Following the strike, a new contract was concluded according to which there was a 4% increase in wages retroactive to November 1, 1978; the present average wage is $11,300 per year. By 1982, annual leave is to increase to 6 weeks. The 40-hour week was maintained, but was reduced effectively by time off to 38 hours, and night shift workers and those over 50 have an extra day off. The strike, the first in the industry in 50 years, cost about $820 million in revenue according to management.

United States Steel sold its share of the Metallhüttenwerke Lübeck GmbH, a large coke and steel producer in the Lübeck area.

Modernization continued in the steel industry in spite of generally poor business conditions and operation at less than 70% capacity.

Demag AG was building two 140-ton oxygen converter installations for a new steel mill of Stahlwerke Röchling-Burbach Völklingen, an Acieries Réunies de Burbach-Eich-Dudelange, S.A. (ARBED, S.A.), Luxembourg subsidiary, in the Saar. The plant is to replace present converter and reverberatory steelmaking facilities at the rate of 1.6 million tons per year.

Friedrich Krupp Hüttenwerke AG acquired from Stahlwerke Röchling-Burbach, a 58.17% stake in the Saar-based drop forging concern, Gerlach-Werke GmbH.

The Steel Commission of the European Communities approved the takover by Hoesch AG of the Siegener AG, a German producer of coated sheet, boosting the group's capacity of coated flat products from about 300,000 tons to 700,000 tons per year.

Mannesmann AG has earmarked $370

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million for its new investment program, three-quarters of which was to be expended domestically. Emphasis was on expansion of the pipe manufacturing plants producing oil industry piping and the construction of a new $100 million blast furnace for the Duisburg-Huckingen steel mill, to replace two older units. About 15% of the funds was to be used for environmental purposes.

The Neukirchner Eisenwerk AG has a new contract with ARBED, Luxembourg, who will supply the company with minette iron ore from its Ferdinand Mine, located in France, across the German-French border.

Thyssen AG announced extensive investment plans for modernizing its plants. In addition to about $250 million left over from existing programs, $445 was earmarked for new projects. New plants included a slab caster at Beeckerwerth, near Duisburg, brought up to capacity and a new electric-arc shop at Oberhausen, near Duisburg and commissioned in the fall of 1979. Plans were prepared to expand hot strip mills; to add a fifth cold rolling stand at Beeckerwerth; and to create new rolling mills for wide strip at the same location.

Cutbacks in uncompetitive divisions included an old rolling mill at Thyssen Niederrhein's Duisburg works; a section mill at the Ruhrort works near Duisburg; and closing of the open hearth shop at Oberhausen during 1979.

Thyssen Edelstahlwerke AG of Düsseldorf received a loan of about $5.5 million from the European Communities to help finance antipollution installatins at No. 3 arc furnace shop at its Krefeld works in the Ruhr.

Although outlook was improving for the steel industry, pickup was only slow and steelmaking capacity was virtually unchanged. Mills were running at about 67% of capacity. Steelmaking capacities of major steel producers are shown in the following tabulation.

Company	Approximate steelmaking capacity in million tons per year
August Thyssen-Hütte	16.5
Hoesch AG	7.2
Klöckner Werke AG	7.2
Peine-Salzgitter AG	6.3
Friedrich Krupp GmbH	4.5
Mannesmann AG	4.5
Stahlwerke Röchling-Burbach AG	2.8
AG der Dillinger Hüttenwerke	2.0
Neunkircher Eisenwerk AG	1.3

At least 48 companies produced stainless and alloy steel, with deliveries totaling about 568,000 tons. The most important producers representing approximately 60% of the Federal Republic of Germany's output, were as follows:

Edelstahlwerke Buderus AG	Lahn
Klöckner Werke AG, Georgsmarienhütte	Osnabrück
Friedrich Krupp Hüttenwerke AG	Bochum
Stahlwerke Röchling Burbach GmbH (ARBED) Völklingen	Saar
Stahlwerke Südwestfalen AG	Siegen
Thyssen Edelstahlwerke AG	Krefeld

Lead, Zinc, and Copper.—In 1978, Preussag-Boliden-Blei GmbH closed down its Harz, Lower Saxony, lead smelter temporarily because of a shortage of lead concentrates due to strikes at suppliers in Peru and elsewhere. Usually 40% of the concentrates is supplied by Boliden while the rest is acquired by Preussag from various foreign sources, including Canada as the most important.

Under terms of an agreement reached between Metallgesellschaft AG and its Lurgi subsidiaries on the one hand and the Ministry for the Metallurgical Industry of China on the other, Metallgesellschaft will receive substantial quantities of ore, nonferrous concentrates, and metals from China over the next 15 years. In return, the Lurgi companies are to establish, over the course of several years, 22 plants for major nonferrous metals in various Chinese provinces. The joint development programs include opening of ore deposits and construction of metallurgical plants.

The Rio Tinto Zinc Co. reached an agreement during the year to buy the Duisburger Kupferhütten AG, an unprofitable enterprise, at the nominal price of Dm 1 from the German chemical companies BASF, Bayer, and Hoechst, each holding 31.4%, Gebrüder Giulini (4.4%); and Henkei (1.3%).

In 1979, the Federal Republic of Germany had three lead-zinc mines serviced by four concentrators. Preussag AG mined about 55% of the country's lead-zinc ores in the Harz region; and Sachtleben Bergbau GmbH produced about 45% at Lennestadt in North Rhine Westphalia. The Luderich Mine of AG des Altenbergs für Bergbau und Zinkhüttenbetrieb in the Cologne region was closed in 1978, because the development of a new deposit was prevented at the mine by a citizen's protest. Some copper concentrate was also produced in the lead-zinc mines.

The Federal Republic of Germany smelter and refinery capacity in the same year was approximately as follows: lead 395,000 tons per year, zinc 435,000 tons per year, and copper 260,000 tons per year. The country's principal operators were Berzelius Metallhütten GmbH's Imperial Smelter (annual capacity: 35,000 tons of lead and 80,000 tons of zinc) at Duisburg Wanheim; Duisburger Kupferhütte GmbH's electrothermic zinc smelter (20,000 tons per year) and electrolytic copper refinery (30,000 tons per year), both at Duisburg; Preussag AG's Harlingerode vertical retort zinc smelter (95,000 tons per year), Nordenham electrolytic zinc refinery (110,000 tons per year) and lead smelter (120,000 tons per year), and Oker lead smelter (45,000 tons per year); Ruhr Zinc GmbH's Datteln electrolytic zinc plant (130,000 tons per year), Norddeutsche Affinerie's Hamburg lead smelter (45,000 tons per year), and Hüttenwerke Kayser AG's Lünen electrolytic copper refinery (15,000 tons per year).

Rare-Earth Metals.—Th. Goldschmidt AG, the country's leading rare earth materials processor prepared mainly about 200 tons of samarium cobalt alloys for permanent magnets in Essen; Treibacher Chemische Werke AG produced mainly cerium-based polishing compounds in Treibach, both from imported materials.

Silver.—Two Federal Republic of Germany companies, Preussag-Boliden-Blei GmbH, a subsidiary of Preussag AG, and Berzelius Metallhütten GmbH, produced about 7 million troy ounces of silver at their lead refineries at Nordenham and Duisburg-Wanheim, respectively.

Tantalum.—The Gesellschaft für Electrometallurgie GmbH in Nuremberg produced some tantalum and potassium tantalum fluoride from tin slags it imported mainly from Malaysia and Thailand. The slags contained about 12% tantalum metal.

Titanium.—In 1978, West German titanium dioxide plant locations, and processes were: Bayer AG operated at Uerdingen, near Kreefeld in the Ruhr, a 75,000-ton-per-year sulfate and a 20,000-ton-per-year chloride process plant; Kronos Titan GmbH, a subsidiary of N.L. Industries Inc., United States, operated an 80,000-ton-per-year sulfate process plant and a 40,000-ton-per-year chloride process plant at Leverkusen near Cologne and a 60,000-ton-per-year sulfate process plant at Nordenham near Wilhelmshaven; and Sachtleben Chemie, a subsidiary of Metallgesellschaft AG, operated a 55,000-ton-per-year sulfate process plant at Homberg-Duisburg in the Ruhr, North Rhine Westphalia.

Metallgesellschaft AG of Frankfurt is considering building a 2,000 to 3,000-ton-per-year titanium metal smelter, since the U.S.S.R. has ceased to export titanium metal.

NONMETALS

Ammonia.—The Badische Anilin und Sodafabrik AG has decided to build an ammonia plant at Ludwigshafen on the Rhein, to cost about $100 million. Capacity is to be 370,000 tons of nitrogen, bringing the company's capacity at this location to almost 1 million tons in 1982.

Barite.—In 1978, the Federal Republic of Germany was a net importer of barites, importing nearly half of its requirements. Although the Federal Republic of Germany had been Europe's largest producer and exporter in 1968, by 1978 the German industry had declined, and it had become more economical to import barite than to operate the higher cost mines. Only six barite mines remained in operation in the country. Deutsche Baryt Industrie Dr. Alberti Co. and Sachtleben Bergbau GmbH controlled two each; Feldhaus Schwerspatgrube GmbH and Preussag AG Metall controlled one each. All mines were located in the Harz Mountains.

Kaolin.—Capacity of major West German kaolin producers was: Amberger Kaolinwerke, Hirschau, Bavaria, 135,000 tons per year; Gebrüder Dorfner GmbH, Scharhof, Bavaria, 100,000 tons per year; Eduard Kick, Schnaittenbach, Bavaria, 110,000 tons per year; and Erbslöh & Co. Geisenheimer Kaolinwerke, Lohrheim-Oberwinter, Northern Rheinland-Pfalz, 80,000 tons per year. There were also four smaller producers of kaolin in the Federal Republic of Germany.

Potash.—Higher demand in foreign markets led to a production increase of about 10%, to about 2.5 million tons of K_2O in 1978; nevertheless domestic sales declined slightly. Potash companies could also increase their salt production because of demand boosted by severe winter conditions. In 1979 potash demand increased again.

About 91% of West German potash output was produced by the nine potash mines of Kali und Salz AG; eight of these were Bergmannssegen-Hugo, Hattorf, Neuhof-Ellers, Niedersachsen-Riedel, Salzdetfurth, Siegfried-Giesen, Sigmundshall, and Wintershall. Kali und Salz's small ninth mine, Hope, is expected to be depleted by 1980,

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and its production personnel were combined with those of the Sigmundshall Mine by Kali und Salz. The second largest West German potash company, Kali Chemie AG, accounted for the remaining 9% of the country's potash production at its Friederichshall Mine near Hannover. The Federal Republic of Germany's potash mines were also located in the Hannover area except for Wintershall and Hattorf, which were east of Kassel on the German Democratic Republic border, and Neuhof-Ellers, which was near Fulda.

MINERAL FUELS

Domestic coal, lignite, natural gas, and crude oil supplied only about 36% of the Federal Republic of Germany's energy. Roughly one-half of the country's energy needs were met by oil imports in 1978. In 1979 the pattern was not much changed. The principal objective of German energy policy is to reduce dependence on imported oil. In 1979, energy consumption grew by 5.9%.

Coal and Lignite.—In 1978, coal production continued to decrease slightly, while lignite production gained somewhat. The still abnormally large stock of coal and coke decreased slightly to 24 million tons. In 1979, production increased about 2.5%, but large deliveries caused stocks to decrease to 18 million tons.

On January 1, 1979, the Government raised coal subsidies paid by consumers of electric power from an average of 4.5% to an average of 6.2% of the electric bills, with actual increased rates varying in each State.

West German Government participations in fuels and power industry were: coal 50%, crude oil production 25%, natural gas 50%, and electric power 75%.

In October 1978, Rheinische Barunkohlenwerke AG (Rheinbraun) started operations at its new Hambach opencast lignite mine in the vicinity of Düren in the Cologne-Aachen Basin. Reserves of 2.4 billion tons are to last for 60 years. In a first phase, to extend until 1983, 600 million cubic meters of overburden are to be stripped, before the first lignite is produced from 20- to 70-meter -thick deposits lying at depths of 200 to 470 meters. At first three 240,000-cubic-meter-per-day excavators will be used, later to be increased to eight to produce 50 million tons of lignite per year.

During 1978, Ruhrkohle AG constructed a 10-kilometer, 6,100-kilowatt underground conveyor belt between the lignite mines of Pattberg and Rossenray on one hand and Rheinpreussen on the other hand. This will enable the company to complement the producing and processing capacities of the mines for the production of 15 million tons of raw lignite and 7.5 million tons of salable product per year.

The Federal Republic of Germany had 40 coal and 17 lignite mines, 21 coking plants, five briquetting plants, and 29 mine mouth powerplants. The bituminous coal industry was controlled mainly by seven companies: three in the Ruhr, two in the Aachen area, and one each in Saarland and Lower Saxony. The largest industrial group was the Ruhrkohle AG, controlling about three-quarters of the country's bituminous coal output.

The lignite industry was dominated by the Rheinische Braunkohlenwerke AG, which accounted for nearly four-fifths of total output; the remaining production came from two medium-sized and four smaller companies.

The Federal Republic of Germany's bituminous coal reserves were estimated in 1974 at 44 billion tons, of which 30 billion tons were recoverable. Total resources were placed at 230.3 billion tons. the Federal Republic of Germany's known lignite reserves were put at 55.5 billion tons, of which 9.5 billion tons were recoverable reserves. Total resources were estimated at 55.9 billion tons.[4]

Nuclear Power.—The Federal Republic of Germany's 15 operating nuclear powerplants generated about 36 million megawatt hours in 1978 and 42 million megawatt hours in 1979. Two nuclear powerplants were inoperative during the year, and two others were still in their commissioning phase, although one of the two went critical during 1978.

The Government of the Federal Republic and Lower Saxony have signed an agreement on financing the construction and operation of a spent nuclear fuel reprocessing and waste disposal center at Gorleben in Lower Saxony, near the border of the German Democratic Republic. According to the present schedule, the center will start full operation only in the late 1980s or early 1990s. At present, the Federal Republic of Germany has only limited nuclear waste storage facilities.

The members of URENCO, a uranium processing consortium composed of the Netherlands, Great Britain, and the Federal Republic of Germany, have approved plans to erect the Federal Republic of Germany's first uranium enrichment plant (centrifuge) at Gronau, near the Dutch city of Almelo. Saarberg Interplan AG, a wholly owned subsidiary of Government-owned Saarbergwerke AG, with uranium operation at Menzenschwald (southern Black Forest) and Gernsbach (northern Black Forest) disclosed that it had 4,000 tons of economically recoverable reserves of uranium, but exploitation of the deposits was nevertheless postponed indefinitely.

Esso Erz GmbH, a wholly owned subsidiary of Esso AG, has disclosed the discovery of uranium deposits in Bavaria, the Black Forest, Hesse, and southern North Rhine Westphalia, some of which it hopes to exploit some time in the future. The company has expended about $10 million during the last 4 years to prospect its uranium concessions.

Kraftwerk Union (KWU), a wholly owned Siemens subsidiary, was the Federal Republic of Germany's leading power station building company. KWU had two nuclear powerplants under construction near Buhsir in Iran, one completed and one underway in Argentina, and eight plants on order in Brazil, four of which were under a firm order.

Petroleum and Natural Gas.—The year 1979 brought lower domestic production of crude oil, higher output of natural gas, and substantially increased imports of crude oil and petroleum products. the Federal Republic of Germany remained West Europe's largest petroleum importer.

BP offered $414 million for a 25% share of Government-controlled VEBA AG, the country's major oil company. The Federal Cartel Office objected to the proposal out of concern for the possible domination of Ruhrgas, a VEBA subsidiary, by the major international oil companies. Ruhrgas is the Federal Republic of Germany's major national gas company. The European Communities also objected to the deal on grounds of a conflict of interest, namely that BP, a leading world supplier of natural gas, would find itself part owner of a process extracting a direct competing fuel (synthetic gas) from Germany's coal reserves. In 1979 the deal was finally concluded.

The Federal Republic of Germany's strategic petroleum reserve law went into effect in 1978. The law creates a quasi-public corporation called Erdölbevorratungsverband (EBV), or Oil Stockpiling Association, to take over stocks from the oil industry equivalent to 65 days' consumption. Companies will be required to hold only 25 days' stocks instead of 90 days as in the past. The industry is contributing to the cost of EBV's maintenance and is to pass on the cost of 0.5 to 1 pfennig per liter to the public.

The German Government approved a contract between a group consisting of Ruhrgas AG and Salzgitter AG on the one hand and Algeria on the other for the import of 4 billion cubic meters per year of natural gas from Algeria to Germany.

Wintershall-Deutsche Texaco has completed a fourth offshore well in the Bay of Eckernförde in the Baltic Sea. There are already several other producing oil wells in the area.

A consortium led by Union Texas Germany Inc., a subsidiary of Mobil Oil Deutschland AG, abandoned as uneconomical offshore well, J13-2, 100 kilometers north of Emden at a depth of 4,800 meters. Onshore, Mobil Oil AG was planning a 5,000-meter exploratory well for natural gas 50 kilometers north of Hannover.

By midyear 10 companies controlled the Federal Republic of Germany's 26 onshore drilling rigs.

Offshore drilling was started at the Dansk Nordsö Tove 1 well located on the border between the West German and Danish zones of the North Sea, 25 kilometers south of the Danish Dan Field. The German Offshore Consortium and the Danish Offshore Consortium participated equally in this venture, with Maersk Oel und Gas GmbH as operators.

The country had three new pipelines in various stages of development. MEGAL GmbH's 165-kilometer, 32-inch crude line from Oberkappel to Schwandorf (completion in 1979); Gasversorgung Süddeutschland's 26-kilometer, 12-inch pipeline from Rottweil to Konstanz (completed); Esso-British Petroleum pipeline from Wilhelmshaven to Hamburg (planned).

The Oberrheinische Mineralölwerke (OMW) completed the 2.4-million-ton-per-year expansion of its Karlsruhe refinery on the Rhein by the construction of Europe's largest and most modern cracking unit.

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Continental Oil Co.'s share in the company was increased by this expansion from 10% to 25%; the shares of Deutsche Texaco and VEBA Chemie have decreased from 45% to 42% and from 45% to 33%, respectively.

In 1978, the Federal Republic of Germany's 21 oil companies controlled 32 oil refineries with a total capacity (throughput) of 159.4 million tons per year.[5]

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[1] Physical scientist, Branch of Foreign Data.

[2] U.S. Embassy, Bonn, Federal Republic of Germany. State Department Airgram A-203, Nov. 15, 1979.

[3] Where necessary, values have been converted to U.S. dollars from Deutsche marks (Dm) at the rate of Dm1.8 = US$1.00 for 1978-79.

[4] Jahrbuch für Bergbau Energie und Chemie 1979-80. P. 785.

[5] Petroleum Economist. V. 46, No. 5, May 1979, p. 179.

The Mineral Industry of Ghana

By Janice L. W. Jolly[1]

The mineral industry of Ghana, like much of the nation's industry in 1978 and 1979, suffered from the general effects of rampant inflation and from shortages of foreign exchange, imported spare parts and materials, and petroleum supplies. The annual rate of inflation was estimated to have fallen from 104% in June 1978 to 79% in June 1979. Ghana was debt-ridden and was fighting to prevent an international declaration of Ghanaian bankruptcy. The country's external debt was over $1 billion[2]. Most firms that depended on foreign sources for raw materials were operating at only 20% to 30% of their capacity by early 1979. The Ghana Industrial Holding Corp. (GIHOC) closed down 9 out of 16 production divisions, including the metal industries and marble works, as a result of raw materials shortages. Banks were unable to establish letters of credit for the corporation, and the Government was unwilling to provide it with adequate import licenses.[3] Ghana experienced a 10% drop in its gross national product (GNP) between 1974 and 1978, measured in real terms. The per capita GNP declined by 18.8% and was compounded by an annual population increase of around 3%.

In a coup on June 4, 1979, the Armed Forces Revolutionary Council (AFRC) took over the Government and instituted corrective measures that were intended to put the country on a recovery path. The AFRC ordered the declaration and examination of the assets of all officers of state corporations and enterprises, and a committee was set up to review all building, civil, and engineering contracts established by the Government since 1970. Price controls were also introduced, but their immediate effect was to increase consumption, which contributed to further shortages. The mood of uncertainty following the coup and an accompanying purge was reflected abroad as well as among local entrepreneurs. Lines of credit and loans agreed upon before the coup were going ahead, but neither foreign governments nor the private sector were showing an inclination to invest in the future. Ghana's first general elections in a decade were held 2 weeks after the coup, and the civilian Government took control on October 1, 1979.

Several loans and grants were organized during 1978 and early 1979 to aid Ghana's industry and development. Six countries had agreed to contribute about $630 million for the Opon Mansi steel development project in the Western Region. Of the total $1,460 million in investments that this project represents, the Federal Republic of Germany, Japan, and Brazil reportedly contributed $200 million, $250 million and $180 million, respectively; and Poland, the Netherlands, and India were also expected to make contributions in unspecified amounts. The Canadian International Development Agency (CIDA) allotted $2.8 million for two major development projects in the Northern and Upper Regions. The Bank for Housing and Construction was expected to receive a $15 million long-term loan from the Central Bank of Brazil to set up building materials industries that would include facilities for the manufacture of cement and iron rods. The World Bank and the European Economic Community (EEC) granted the Ghana National Investment Bank a total credit facility of $25 million ($19 million from the World Bank, $6 million from the EEC) in July 1979 for use in acquiring spare parts and essential raw materials. Ghana and West Germany signed a loan agree-

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ment for $8.3 million to meet Ghana's urgent foreign exchange requirements for 11 institutions, including the GIHOC and Saltpond Ceramics. West Germany also granted Ghana $65 million for electricity development and transportation facilities on the Volta Lake. The United Nations Development Programme's (UNDP) resources for Ghana were increased from $15 million for the first country program (1972-76) to $19 million for the second program (1977-81). UNDP resources available for the 1979-81 period totaled $10.75 million, including $3.5 million for mining. A major share was designated for the improvement of gold and diamond output and for building up Ghana's capacity to train its own mining technicians. About $907,000 was designated for mining engineer training, $532,000 for operational assistance to the state Gold Mining Corp. (GMC), and about $188,000 for diamond prospecting on the Birim River. In early 1979, Ghana's mining companies were also benefiting from a new British line of credit worth $20 million that was intended to be used partly for machinery and spares. The Standard Chartered Merchant Bank of London also negotiated a development loan to Ghana for $19 million.

It is expected that power for future mining projects will be required in far greater quantities than is currently available. A major hydroelectric scheme was under construction at Kpong, downstream from the Akosombo Dam. However, there were long delays in the arrival of equipment necessary for construction of the station, and completion was not expected for several years. The Volta River Authority (VRA) and Sadelmi Cogepi of Italy signed a $7 million contract for mechanical and electrical services for the Kpong hydroelectric project in early 1979. CIDA was planning to assist in the relocation of 7,000 people displaced by the Kpong project. In December 1978, VRA and the Ivory Coast Electricity company signed a protocol agreement for the interconnection of the electrical networks of the two countries. Plans were for the project to be financed by the African Development Benk (ADB), the European Investment Bank (EIB), Ghana, and the Ivory Coast. Water supply was also a problem in early 1979; it was interrupted by a major blockage in the Kpong-Tem-Accra main water pipeline, which supplied 80% of Accra's water. The cement lining was crumbling all along the pipe. All industries, including the aluminum and refined petroleum industries, were dependent upon a sufficient supply of water.

PRODUCTION AND TRADE

Ghana's mineral production was valued at $238 million for 1978, including production of aluminum from imported alumina. Gold production fell during 1978, compared with that of 1977 and sales were $26.4 million in 1978, compared with $32 million in 1977. Gold revenues received were much higher in 1979 (nearly $300 million) because of the rise in gold prices on the international market. Bauxite production increased while world prices remained generally stable, with a slight upward trend. Total bauxite sales for the year ending in March 1978 were about $2.9 million. During this same period, Ghana Consolidated Diamonds Ltd. (GCDL) produced revenues of $14.8 million from the sale of diamonds. Although diamond output was down, this was generally offset by higher prices for both 1978 and 1979. Manganese production improved, and the Ghana National Manganese Corp. (GNMC) continued to pursue a proposed nodulization plant project that was expected to make the company more viable when the oxide ores phase out. Manganese was shipped from the port of Takoradi for export to nine countries: the United Kingdom, Japan, Belgium-Luxembourg, Spain, Ireland, the German Democratic Republic, Norway, the Netherlands, and Portugal.

The decision to float Ghana's currency, the new cedi, on July 19, 1978, was accompanied by a new set of economic measures that included suspension of Special Unnumbered Import Licenses (SUL's), which were introduced in 1976 to improve the supply of imported commodities. Under SUL's, importers who had their own foreign exchange were allowed to operate outside the import program for bringing goods into the country. In practice, however, the system was increasingly abused by currency speculators. The 1978-79 budget was designed to try to curb imports of nonessential consumer goods, and the import bill was to be restricted to the 1977 level while a system of import license priorities was established. The priority sectors, raw materials and spare parts, were supposed to receive their allocations, but foreign exchange was tight. A government decree (Export Bonus Amendment Decree, SMCD 134) was also enacted, effective July 1, 1978, to credit gold producers with an additional 20% of the revenue from exported gold bullion.

Oil imports continued to be a problem. Ghana's oil import bill accounted for 30% of the country's total imports in 1978 and amounted to almost $300 million. Nigeria had supplied 80% of Ghana's crude oil requirements, but by June 1979, the Nigerian Government ceased petroleum shipments to the Tema refinery, objecting to persecution during the Ghanaian Government coup. In an effort to obtain crude oil from other sources, Ghana negotiated with Algeria for crude petroleum supplies. Although deliveries from Nigeria were renewed by October, 1979, Ghana endured severe shortages of essential gasoline throughout the country for the remainder of the year. Ghana began crude petroleum production from the Saltpond field in mid-October 1978.

Table 1.—Ghana: Production of mineral commodities

Commodity[1] and unit of measure	1976	1977	1978[p]	1979[e]
Aluminum:				
Bauxite, gross weight ---- metric tons	271,568	244,217	328,087	300,000
Metal, smelter, primary ------do	151,391	153,468	111,364	[3]168,727
Cement ------- thousand metric tons	[e]650	610	500	400
Diamond:				
Gem ----------- thousand carats	228	290	142	150
Industrial ---------------do	2,065	[e]1,717	1,281	1,350
Total---------------do	2,293	1,947	1,423	1,500
Gold --------- thousand troy ounces	532	481	402	482
Iron and steel: Crude steel --- metric tons	15,000	15,000	10,000	5,000
Manganese ore and concentrate, gross weight do	311,872	291,565	315,577	272,160
Petroleum refinery products:				
Gasoline -- thousand 42-gallon barrels	1,890	1,928	2,231	2,200
Jet fuel---------------do	385	392	309	300
Kerosine---------------do	732	747	1,046	1,000
Distillate fuel oil ---------do	2,452	2,531	2,455	2,400
Residual fuel oil ---------do	2,440	2,529	2,080	2,000
Other---------------do	98	92	187	130
Refinery fuel and losses------do	466	384	388	390
Total---------------do	8,463	8,663	8,651	8,420
Salt[e] ------------- metric tons	52,000	50,000	50,000	50,000
Silver, mine output, metal content thousand troy ounces	NA	NA	19	20

[e]Estimate. [p]Preliminary. NA Not available.

[1]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) is produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

COMMODITY REVIEW

METALS

Aluminum.—The joint venture between Ghana Bauxite Co. and the Government was extended for another 5 years. No new developments were reported in the much-postponed Nyinahin and Kibi bauxite mining projects. Aluminum production by the Volta Aluminum Co. (VALCO) was severely disrupted by a massive power failure that brought production to a complete halt in the second quarter of 1978. By yearend, four of VALCO's five potlines were back in operation, but total production for 1978 was down by about 27% from that of 1977. Hundreds of workers in the industry were laidoff as a result of the shutdown. A $10 million aluminum rolling mill was planned by the Ghana Aluminum Industries Commission, The Ghana Social Security Bank, and the National Investment Bank for Tema. Hunter Engineering SPA of Italy was expected to supply equipment and personnel and was awarded a 2-year management contract. Hunter was also providing a loan for the equipment. It was planned that aluminum ingots for the mill would be obtained from VALCO.

Columbium-Tantalum.—A prospecting license for columbium-tantalum was granted by the Government to Amalgamated Mining Co. (Ghana) Ltd. (AMC) on November 12, 1976, and the rights were extended on September 1, 1977, until November 11, 1978. On August 21, 1978, AMC entered into an agreement with Columbite Exploration and Development Co. (Ghana) Ltd. (CEDCo) to prospect for columbite. The West German firm Gesellschaft fur Elektrometallurgie GmbH was a 49% shareholder of CEDCo; and AMC, made up mainly of Ghanaians, held 51% of the shares. CEDCo started initial exploration activities in 1979.

Gold.—Total gold production in 1978 declined sharply from that of 1977. The decrease in production resulted largely from a cutback at Ashanti Gold Fields Corp. mine. Ashanti was sinking a new subvertical shaft that was expected to permit extraction of an additional 75,000 tons of ore over the next 10 years. Completion of the shaft was expected by 1981. Continued improvements to the mill circuit resulted in an improvement in gold recovery to 83.5%. From 1912 to the end of March 1978, the Ashanti mine had crushed a total of 20.9 million tons of ore, yielding 16.2 million fine ounces of gold. The company's property covered an area of 259 square kilometers in the Bekwai and Obuasi districts of the Ashanti Region. Ashanti's ore reserves were reported at approximately 4 million metric tons with an average grade of 0.75 troy ounces per ton.

The GMC mine at Dunkwa (Dunkwa Goldfield Ltd.) produced 154,914 ounces in 1978. Ore reserves at Dunkwa totaled 265 million cubic meters at the end of March 1978. Dunkwa was the only gold concession where gold was being recovered from river gravels by dredge. The company's dredging concessions extend on either side of the Ofin River some 58 kilometers upstream to the Jimi River, and north to the Ashanti concession boundary. From 1912 to March 31, 1978, the company treated a total of 202 million cubic meters of gravel, yielding 1.4 million fine ounces of gold.

The GMC mine at Tarkwa (Tarkwa Goldfields Ltd.) produced approximately 3.9 million fine ounces of gold between 1912 and March 1978. Tarkwa produced 56,356 ounces in 1978. Ore reserves at January 1, 1976 were estimated to be 133,177 metric tons averaging 1.4 ounces per ton.

The GMC mines at Prestea, (Prestea Goldfields Ltd.), Bondaye, and Tuappim, had combined ore reserves of approximately 1.8 million tons with an average grade of 0.34 ounces per ton. Prestea Goldfields Ltd. comprised the former Prestea Goldfields and the Ghana Main Reef and Ankobra River Power Companies and was first registered in 1929. From 1912 to March 1978, about 5.6 million ounces of gold were produced from 291,895 tons of ore.

The GMC mine at Konongo (Konongo Goldfields Ltd.) had available ore reserves of approximately 17,684 tons with an average grade of 0.26 ounces per ton over a distance of 10.5 meters at the end of March 1977. Decreased production for 1978 (5,296 ounces) was the result of very poor grade ore. Between 1912 and March 1978, a total of 3 million tons of ore had been crushed to yield 1.4 million ounces of gold. The total concession area was about 52 square kilometers including Attunsu, Boabedroo, Occomadesia, and Odumasi. All Konongo ore was shipped by rail to the Tarkwa mill for custom treatment.

Iron and Steel.—Construction continued on the iron and steel smelter complex between Takorandi and Sekondi. It was anticipated that about 1 million tons of ore per year would be mined at the Opon-Mansi iron ore deposit to feed the new complex. Charcoal for smelting was expected to be supplied from Daboase at the rate of 100,000 tons per year. Limestone for flux was expected to be supplied from the Nauli deposits. The Opon-Mansi iron ore deposit was being developed by the Integrated Iron and Steel Commission (ITSC). The Opon-Mansi deposit is mainly a lateritic capping with low silica and phosphorous contents (8% and 1%, respectively). Its average iron content is 41%; and its average alumina content is 14% . Reserves were estimated at 150 million tons. Because of a lack of funds needed for the purchase of high-voltage transformers, completion of the plant was delayed past the expected April 1978 completion date, and large quantities of chemicals that were imported for use in the new foundary were reported to be unusuable in 1979. In June 1979, the National Bank granted ITSC $500,000 to pay for imports of equipment needed for the plant.

Manganese.— GNMC contracted Fuller Corp. to upgrade the carbonate reserves at Nsuta. The plant, which was expected to cost approximately $18 million to design and equip, was due for completion in 1980 and was expected to allow production to remain at present levels. The nodulizing process to be used at Nsuta involves crushing the manganese carbonate ore and heating it in a rotary kiln to drive off the carbon dioxide. Additional heating allows the material to soften and form spherical nodules about 1 inch in diameter. The kiln was designed to be 16.5 feet in diameter and 375 feet long. The plant's projected capacity was 1,100 tons per day of manganese concentrate. The country's oxide reserves were almost exhausted, and the evaluation of other commercial-grade ores–carbonates in particular–continued. Several manganese deposits were under investigation at Yakau, near Dixcove, Western Region. Five main deposits were mined at Yakau prior to 1952, and the recovered manganese was shipped to Europe. The deposits had a 42% manganese content in 1952, and it was considered likely that a considerable amount of ore (5.5 million tons) can still be found here. The manganiferous zone near Ntereso and Branfo, Northern Region was also considered to have potential, with ore reserves estimated at 2.5 million tons containing 30% to 45% manganese.[4]

Uranium.—Desmond Co. of Canada was assessing uranium deposits in eastern Ghana. It was reported that the Ghanaian Government was spending $380,000 for prospecting for uranium and other minerals in the region.

NONMETALS

Clays.—Saltpond Ceramics Ltd. was exploiting the kaolin deposit at the Abandze-Saltpond bypass, in the Central Region for use in the production of toilet bowls, sinks, plates, and crockery. The kaolin deposits of this area are closely associated with the pegmatites that occur along the coast from Saltpond to Biriwa and are derived from them. Kaolin deposits also occur in association with the bauxite deposits of the Atewa Range, about 10 kilometers northeast of Kibi, Eastern Region. These are the largest known kaolin deposits in Ghana. They occur in three swamps and have an average thickness of 18 meters. The ore reserves of the Atewa Range were estimated at 3.3 million tons containing 60% kaolinite, 30% silica, 5% mica, 0.77% $K_2$0 and 0.01% $Na_2$0. Investigations were still underway to determine the economic suitability of the Atewa Range ores for the manufacture of tiles and household utensils.

Brown plastic clays suitable for brick and tile manufacture occur in all Regions of Ghana. The Ghana Geological Survey Department has made surveys and maps of some of these deposits that indicate their locations and estimated reserves.[5]

Diamond.—Between 1920 and March 1978, a total of 28 million carats of diamond had been exported from Ghana, mainly from the GCDL mine at Akwatia, Eastern Region. Diamond production decreased in 1978 and 1979. A serious decline in production was caused by increased difficulties in importing macinery and spare parts because of persistent foreign exchange constraints. In the fiscal year that ended March 31, 1978, a total of 1,881,199 carats of diamond was recovered from 1,111,771 cubic meters of gravel, compared with around 2 million carats in the previous year. An amount equivalent to about 4% of the total produced by GCDL was also produced by local licensed diggers. The reserves of the present GCDL concession in the Akim Abuakwa and Akim Kotoku areas were expected to be exhausted by 1982. Prospecting was continuing on the Birim River below Akwatia to the confluence with the Pra River. These areas were believed to have a potential of 50 million carats. On August 24, 1979, the UNDP allocated $2 million spread over 3 years for the Birim River Diamonds Prospecting Project. The GCDL minority partner, Consolidated African Selection Trust, was expected to carry out the prospecting program. It was anticipated that a substantial investment in new surface mining equipment would also be required before operations can begin in the new area.

Limestone.—Since the discovery of the Nauli limestone deposits in 1922, ten feasibility studies have been completed by the Ghana Geological Survey Department and others. A major conclusion has been that underground mining would not be possible because of engineering and technological difficulties. Opencast mining was planned to produce limestone for use as a flux in the Integrated Iron and Steel's Opon-Mansi project. Ore reserves at Nauli were estimated at 400 million tons with an average content of 51.86% Ca0, 1.74% $Si0_2$, 1.6% Mg0, 0.80% Al_20_3, and 0.79% Fe_20_3.

Deposits of limestone suitable for cement occur at Bonga-da and Buipe, Northern Region. It was estimated that there were at least 15 million tons of very good quality limestone and some 25 million tons of dolomite in the Bongo-Da area. Geological investigations have proved 6.62 million tons of low-magnesium limestone that could be mined from four quarry sites in this area. At Buipe, approximately 14 million tons of limestone suitable for portland cement production and 22 million tons of dolomite suitable for production of Roman or natural

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cement was available. The limestone could be mined opencast in four areas, and the raw materials could be transported by Volta Lake.

MINERAL FUELS

Petroleum.—In 1978 and 1979, several U.S. companies were actively involved in oil production and exploration in Ghana. These included: Agri-Petco Co. (Tulsa, Okla.); Phillips Petroleum Co. (Bartlesville, Okla.); Texaco, Inc. (New York); J. J. Simons (Muskogee, Okla.) Offshore Hydrocarbons (Muskogee, Okla.); Aracca Petroleum Corp. (New York); Texas International Petroleum Co. (New York); and Louisiana Land and Exploration Corp. (New Orleans, La.). A Phillips Petroleum Group (Phillips, 50% ownership; Azienda General Italliani Petroli S.p.A. (AGIP), 25%, and Getty Oil, 25%) was drilling three wells in its offshore concessions and found 32° API oil at 12,000 feet in one of them. Some associated gas (8.2 million cubic feet per day) was also found. Louisiana Land Corp. acquired two-thirds of Agri-Petco's offshore concessions and was looking for a partner before taking steps to explore in these areas. Agri-Petco was the only producing company.

Agri-Petco began production from the Saltpond field in mid-October 1978. By November, the high-gravity, low-sulfur crude oil from this field was being produced from six wells at the rate of 5,000 barrels per day. Reserves of 36° and 40° API crude oil were estimated at about 6 million barrels. The field was being developed under a 30-year contract. Agri-Petco Ghana Inc. (owned 42.8% by Texas City Refinery, 42.8% by National Cooperative Refinery Assoc., and 14.4% Farm Bureau Oil Cooperative) was also granted investment insurance by the Overseas Private Investment Corp. (OPIC). Agri-Petco's investments totaled some $40 million to yearend 1978. By 1979, output had declined to 3,200 barrels per day because of technical problems and because the wells were shut down for a month in July 1979 for maintenance work. The Government takes a 12.5% royalty on oil produced and has an option to buy 50% of the output.

Four corporations were under the Ministry of Fuel and Power; they were the VRA, the Electricity Corp., the Ghanaian Italian Petroleum Limited (GHAIP), and the Ghana Oil Co. Ltd. (GOIL). The Ministry called upon GOIL and GHAIP to find ways to improve the distribution of petroleum products throughout the country and to coordinate operations between the GHIP refinery at Tema and the oil distributing company GOIL. In order to improve the distribution of petroleum products, bulk haulage of petroleum products by railroad was planned to be introduced along with the construction of storage tanks at various strategic points within the country. During the 1978-79 period, certain petroleum products, including line engine oil, brake fluid, ear oil, and insecticides, disappeared from the country's petroleum stations and were being sold at high prices on the black market. Lacking sufficient credit, the oil distribution companies had apparently not imported any of these products for some time, thus creating a shortage.[6] GOIL was planning to build a $2 million engine oil plant at Tema.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from the Ghanaian new cedi (Nc) to U.S. dollars at the rate of Nc1 = US$0.87 for 1978 and Nc1 = US$0.38 for 1979.

[3] West Africa (London). Critical Raw Materials Lack. Oct. 15, 1979, p. 1909.

[4] Kesse, G.O. A Table of Summary of the Mineral Resources of Ghana. Republic of Ghana Geological Survey, Accra, Ghana, Report No. 79/1, Apr. 19, 1979.

[5] Kesse, G.O. A Table of Summary of the Mineral Resources of Ghana. Republic of Ghana Geological Survey, Accra, Ghana, Report No. 79/1, Apr. 19, 1979, p. 16.

[6] Daily Graphic (Accra, Ghana). Oil Products Shortage Noted. Feb. 26, 1979, p. 1.

The Mineral Industry of Greece[1]

By Roman V. Sondermayer[2]

During 1978 and 1979, the mineral industry of Greece showed mixed results. In general, the international steel crisis adversely affected the country's mineral exports; but in the second half of 1979, increased activities in European stainless steel boosted exports of magnesite and nickel. Also, the construction boom in countries where crude oil is produced stimulated Greek cement exports. The Government of Greece participated considerably in the activities of the country's mineral industry; it was a dominant factor in crude oil, lignite, and chromite production, in exploration for all minerals, and in the financing of mineral activities. The mineral industry's share in the gross national product (GNP) in 1978 was about 7.3%, reflecting a drop of 0.2%, compared with the industry's share in 1977. Mining accounted for 1.3% of the mineral industry's share in GNP in 1978. The mineral industry employed an estimated 20,000 persons, or 0.6% of the total labor force.

Bauxite, nickel, and nonmetals continued to be the most important minerals produced in the country.

During 1978 and 1979, the most important developments in the Greek mineral industry were expansion of bauxite mines and an alumina plant; completion of new nickel-producing installations; and the start of construction of an asbestos mine and mill.

PRODUCTION

The Greek mineral industry was owned both by the Government and by the private sector. The Government acted through publicly owned corporations, of which the ones of principal interest to the mineral industry were Public Power Corp. (PPC); Hellenic Industrial & Mining Co. (HIMIC); the Public Petroleum Co. (DEP); Project Studies and Mining Development Corp., S.A. (GEMEE); the Institute of Geological and Mining Research (IGME); and, for financing, the Hellenic Industrial Development Bank (ETVA). In the private sector, the major mining companies were the Bodossakis Group (nickel, sulfide ores and concentrates, fertilizers, etc.); the Eliopoulou-Kyriacopoulou Group (bauxite, perlite, expanded perlite, bentonite, barite, and kaolin); the Scalistiri Group (magnesite, refractories, bauxite, and chromite); Aluminium de Grèce S.A. (aluminum); Grecian Magnesite (magnesite); Mykobar S.A. (barite, bentonite); and four companies that shared Greece's cement output, Heracles (known also as General), Titan, Chalkis, and Halyps.

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Table 1.—Greece: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Bauxite, gross weight thousand tons	2,551	2,984	2,530	[p]2,915
Alumina, gross weight do	450	474	482	485
Metal, primary	133,900	131,715	145,006	[p]140,830
Antimony, mine output, metal content	220	--	--	--
Chromite:				
Run-of-mine ore	66,849	72,056	69,000	[p]57,082
Marketable products:				
Direct-shipping ore[3]	7,381	[e]8,000	[e]7,000	10,000
Concentrate	26,908	33,450	32,878	[p]44,767
Copper, mine output, metal content	[r]2,600	3,500	300	--
Iron and steel:				
Iron ore and concentrate, nickeliferous, gross weight[4] thousand tons	2,205	2,050	1,685	1,570
Metal:				
Pig iron and ferroalloys do	400	440	600	360
Crude steel do	715	759	936	1,000
Semimanufactures[5] do	NA	[e]650	[e]650	650
Lead:				
Mine output, metal content	[r]28,200	16,400	20,300	20,000
Metal, refined:[6]				
Primary	[r]16,792	14,527	17,014	19,000
Secondary	1,900	[e]4,200	[e]5,600	6,000
Manganese, gross weight:				
Ore, crude	58,248	45,287	67,268	68,000
Concentrate	8,233	7,830	7,010	[p]5,750
Nickel:				
Ni content of nickeliferous iron ore[7]	27,561	25,622	21,900	21,000
Ni content of alloys	16,448	9,600	15,100	18,900
Silver:				
Mine output, metal content thousand troy ounces	1,845	1,070	1,360	1,400
Metal content of alloys do	488	[e]500	[e]500	500
Tin metal, primary	34	[e]30	[e]30	30
Zinc:				
Mine output, metal content	26,473	18,000	25,600	25,700
Metal, including secondary	[e]10	[e]10	--	--
NONMETALS				
Abrasives, natural: Emery	6,500	6,500	8,000	8,000
Asbestos[8]	2,000	35	40	NA
Barite:				
Crude ore	90,620	95,794	110,841	100,000
Concentrate	43,586	38,579	44,691	48,007
Cement, hydraulic thousand tons	8,745	10,584	11,280	[p]12,098
Clays:				
Bentonite:				
Crude	316,769	419,449	347,617	361,992
Processed	290,450	336,787	286,435	355,000
Kaolin:				
Crude	76,725	65,396	49,916	54,000
Processed	9,865	9,000	12,780	13,000
Fluorspar, grade unspecified	[e]1,000	500	610	590
Gypsum and anhydrite	444,686	410,000	[e]480,000	450,000
Magnesite:				
Crude thousand tons	1,284	1,040	820	770
Dead-burned	341,484	350,795	268,258	270,000
Caustic-calcined	57,456	77,047	92,862	95,000
Nitrogen, N content of ammonia	238,005	225,000	229,000	227,000
Perlite:				
Crude	228,081	374,245	223,585	226,000
Screened	126,732	148,125	134,695	135,600
Pozzolan (Santorin earth) thousand tons	981	1,256	1,420	1,540
Pumice	399,745	568,292	750,152	800,000
Pyrite, gross weight	180,368	128,556	146,870	150,000
Salt, all types thousand tons	140	190	133	135
Silica (probably silica sand)	16,866	25,448	26,162	27,000
Sodium compounds:				
Sodium sulfate thousand tons	5	6	6	6
Sodium carbonate do	1	1	1	1
Stone: Marble cubic meters	170,000	NA	250,000	NA
Sulfur:				
S content of pyrite thousand tons	81	58	250	75
Byproduct of petroleum do	3	3	3	3
Talc and steatite	5,543	--	1,078	--

See footnotes at end of table.

Table 1.—Greece: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS				
Coal, including briquets:				
Lignite ---- thousand tons	22,303	23,572	21,779	22,000
Lignite briquets ---- do	50	90	73	70
Coke:				
Coke oven ---- do	337	300	300	310
Gashouse ---- do	12	15	12	14
Gas, manufactured:				
Gasworks ---- million cubic feet	274	270	270	NA
Blast furnace ---- do	35,308	NA	NA	NA
Coke oven ---- do	6,353	NA	NA	NA
Petroleum refinery products:				
Gasoline ---- thousand 42-gallon barrels	8,424	8,458	10,668	[3]10,812
Jet fuel ---- do	4,728	4,504	5,408	[3]10,064
Kerosine ---- do	395	326	310	[3]348
Distillate fuel oil ---- do	19,918	20,642	21,559	[3]26,363
Residual fuel oil ---- do	35,112	33,067	35,418	[3]46,679
Lubricants ---- do	385	467	731	[3]756
Other ---- do	8,523	7,361	6,658	[3]11,759
Refinery fuel and losses ---- do	4,248	3,668	4,789	[3]5,852
Total ---- do	81,733	78,513	85,541	[3]112,633

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, a variety of other crude construction materials (clays, sand and gravel, and stone) is produced, but output is not reported and available information is inadequate to make reliable estimates of output levels. Cobalt is also produced and is included with nickel.

[2] Reported figure.

[3] Exports.

[4] Ni content is also reported under "Nickel."

[5] Black sheet, galvanized sheet, reinforcing bars, and wire only.

[6] Includes antimonial lead and hard lead.

[7] Also includes Co content.

TRADE

During 1978, Greece again had a negative foreign trade balance, caused mostly by imports of fuels. Overall exports of the sector showed an increase by 20%, and metal exports increased by 14%, but exports of ores and minerals decreased by 1.6%. Trade in 1979 continued at the same level as in 1978. The United States had a positive trade with Greece.

Tables 2 and 3 show details of the country's trade in minerals.

Table 2.—Greece: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS			
Aluminum:			
Bauxite and concentrate thousand tons	1,367	1,752	U.S.S.R. 600; Romania 427; Netherlands 308.
Oxide and hydroxide	194,782	NA	
Metal including alloys:			
Scrap and unwrought	88,970	78,625	Italy 33,688; France 29,798; Lebanon 9,918.
Semimanufactures	17,888	24,158	Federal Republic of Germany 5,791; Saudi Arabia 5,466; Iraq 1,520.
Chromite	21,957	74,939	Netherlands 32,155; Romania 13,850; Federal Republic of Germany 7,800.
Copper:			
Matte	147	NA	
Metal including alloys:			
Scrap	781	890	Italy 636; Belgium-Luxembourg 205.
Unwrought	--	112	Mainly to Belgium-Luxembourg.
Semimanufactures	3,809	4,629	Federal Republic of Germany 797; France 623; Syria 501.

See footnotes at end of table.

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Table 2.—Greece: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS —Continued			
Iron and steel:			
Ore and concentrate, except roasted pyrite	1,100	450	NA.
Roasted pyrite	18,575	11,555	Mainly to Federal Republic of Germany.
Metal:			
Scrap	1,024	1,077	Netherlands 477; Federal Republic of Germany 335; Italy 185.
Pig iron and similar materials	13	129	Italy 21; United Kingdom 20.
Ferroalloys: Ferronickel	57,035	44,698	Federal Republic of Germany 16,741; Canada 9,238; France 7,084.
Steel, primary forms	17,654	13,515	Italy 8,397; United Kingdom 5,117.
Semimanufactures:			
Bars, rods, angles, shapes, sections	64,699	42,134	Albania 17,805; Cyprus 13,313; Bulgaria 7,955.
Universals, plates, sheets	119,171	119,362	Yugoslavia 93,803; Italy 6,416; Cyprus 4,858.
Hoop and strip	664	1,370	China, mainland, 500; Syria 475.
Rails and accessories	13	--	
Wire	986	1,021	Libya 377; Albania 287.
Tubes, pipes, fittings	51,728	44,715	Libya 19,622; Cyprus 9,749; United States 5,360.
Castings and forgings, rough	761	152	NA.
Lead:			
Ore and concentrate	37,708	20,832	Belgium-Luxembourg 7,000; Italy 7,000; United Kingdom 4,500.
Metal including alloys, all forms	70	837	Egypt 500; Turkey 200; France 63.
Manganese ore and concentrate	1,515	2,110	Yugoslavia 918; France 600; Algeria 575.
Zinc ore and concentrate	50,462	23,364	France 9,100; Italy 8,446; United Kingdom 3,500.
Other:			
Ores and concentrates	8,500	16,290	United Kingdom 10,500; Italy 2,040; Belgium-Luxembourg 1,501.
Ash and residue containing nonferrous metals	22,846	NA	
Waste and sweepings of precious metals	5	NA	
Oxides, hydroxides, peroxides of metals	3,582	10,819	U.S.S.R. 2,800; United Kingdom 1,634; Federal Republic of Germany 1,088.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	164,230	NA	
Grinding and polishing wheels and stones	57	103	NA.
Barite and witherite	33,695	(1)	
Cement thousand tons	3,907	3,841	Nigeria 869; Libya 729; Iraq 307.
Clays and clay products (including all refractory brick):			
Crude	398,543	(1)	
Products:			
Refractory (including nonclay brick)	21,440	17,258	Iraq 4,925; France 3,204; Italy 1,924; Poland 1,854.
Nonrefractory	11,939	17,104	Saudi Arabia 5,203; U.S.S.R. 5,155; Cyprus 2,759.
Fertilizer materials, manufactured:			
Nitrogenous	20,438	NA	
Phosphatic	--	6,989	All to Libya.
Potassic	NA	3,985	Do.
Other, including mixed	10,935	116,742	Turkey 60,000; China, mainland, 43,150; Cyprus 6,532.
Gypsum and plasters	6,193	NA	
Lime	36,982	10,796	Saudi Arabia 6,818.
Magnesite	354,531	(1)	
Mica, crude, including splittings and waste	1,600	(1)	
Precious and semiprecious stones, except diamond, natural value, thousands	$132	NA	
Sodium compounds: Caustic soda	102	NA	
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	36,079	40,108	Italy 12,573; Yugoslavia 8,177; Federal Republic of Germany 4,611.
Worked	62,891	31,127	Saudi Arabia 11,509; Libya 6,997; Federal Republic of Germany 4,569.
Gravel and crushed rock	15,124	4,368	NA.
Limestone and other calcareous stone	6,233	7,306	Saudi Arabia 4,520.
Quartz and quartzite	8,746	(1)	
Sulfur:			
Elemental, other than colloidal	9,532	23,938	Turkey 17,295; Bulgaria 4,550; Algeria 1,408.
Sulfuric acid	72,058	NA	

See footnotes at end of table.

Table 2.—Greece: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
NONMETALS —Continued			
Other:			
Crude thousand tons	188	1,002	Federal Republic of Germany 183; Italy 117; United Kingdom 70.
Slag, dross, and similar waste, not metal bearing	9,030	6,522	Italy 850; Spain 198.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	40,079	35,711	United Arab Emirates 8,688; Saudi Arabia 7,855; Cyprus 7,100.
MINERAL FUELS AND RELATED MATERIALS			
Coal: Lignite	3,254	19,547	Mainly to Yugoslavia.
Coke and semicoke	36,742	NA	
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	233	NA	
Refinery products:			
Gasoline, motor do	411	230	Netherlands Antilles 206.
Kerosine and jet fuel do	2,780	2,623	United States 684; Switzerland 231; Netherlands 202.
Distillate fuel oil do	2,443	1,885	United States 1,013; Cyprus 221; Italy 217.
Residual fuel oil do	6,064	2,995	Italy 2,088; Denmark 491.
Lubricants do	76	400	Syria 163; United States 130.
Other:			
Mineral jelly and wax do	1	10	Republic of South Africa 7.
Liquefied petroleum gas do	59	NA	
Unspecified[2] do	24	43	United Arab Emirates 19; Zaire 14.

NA Not available.

[1] Included in "Other crude nonmetals."

[2] Includes bitumen and petroleum coke.

Table 3.—Greece: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum:		
Bauxite and concentrate	4,183	3,987
Metal including alloys:		
Scrap	386	309
Unwrought	3,646	4,527
Semimanufactures	2,389	3,759
Chromium:		
Chromite	1,173	1,091
Oxide and hydroxide	147	(1)
Copper:		
Copper sulfate	1,040	NA
Metal including alloys:		
Scrap	17	209
Unwrought	23,968	22,537
Semimanufactures	2,119	1,294
Iron and steel:		
Ore and concentrate ... thousand tons	870	846
Metal:		
Scrap	90,700	93,259
Pig iron, including cast iron	14,599	17,297
Sponge iron, powder, shot	527	741
Ferroalloys	8,058	10,643
Steel, primary forms	245,849	177,703
Semimanufactures:		
Bars, rods, angles, shapes, sections	170,870	199,743
Universals, plates, sheets	172,594	232,938
Hoop and strip	86,077	87,989
Rails and accessories	2,081	1,708
Wire	13,864	8,878
Tubes, pipes, fittings	22,823	23,069
Castings and forgings, rough	1,667	2,224
Lead:		
Ore and concentrate	19,294	7,278
Metal including alloys, unwrought and semimanufactures	10,223	7,087
Magnesium metal including alloys, unwrought	477	(1)
Manganese:		
Ore and concentrate	11,081	(1)
Oxides	205	NA
Nickel metal including alloys:		
Unwrought	70	[illegible]
Semimanufactures	373	[illegible]
Platinum-group and silver metals including alloys:		
Platinum-group ... value, thousands	$417	$714
Silver ... do	$12,355	$18,670
Tin metal including alloys, unwrought and semimanufactures	344	413
Titanium oxides	7,009	(1)
Zinc:		
Oxide	605	(1)
Metal including alloys:		
Unwrought	12,964	13,851
Semimanufactures	170	124
Other:		
Ores and concentrates	752	1,901
Ash and residue containing nonferrous metals	36	NA
Oxides, hydroxides, peroxides of metals	63	5,275
Metals including alloys, all forms:		
Metalloids	380	NA
Alkali, alkaline-earth, rare-earth metals	3,664	NA
Base metals including alloys, all forms, n.e.s	58	571
NONMETALS		
Abrasives, natural, n.e.s.:		
Dust and powder of precious and semiprecious stones ... value, thousands	$1,968	[4]$3,327
Grinding and polishing wheels and stones	206	409
Asbestos	20,420	19,650
Boron materials:		
Crude natural borates	597	(1)
Oxide and acid	78	(1)
Cement	496	NA
Chalk	2,741	(1)
Clays and clay products (including all refractory brick):		
Crude	90,726	(1)
Products:		
Refractory (including nonclay brick)	22,728	20,259
Nonrefractory	6,873	16,451
Diatomite and other infusorial earth	387	NA
Feldspar and fluorspar	12,034	(1)

See footnotes at end of table.

Table 3.—Greece: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
NONMETALS —Continued		
Fertilizer materials:		
Crude:		
Phosphatic	346,544	132,467
Other	812	70
Manufactured:		
Nitrogenous	97,276	51,219
Potassic	51,782	6,421
Other, including mixed	1,175	1,316
Ammonia	51,362	(⁶)
Gypsum and plasters	885	NA
Magnesite	374	(³)
Pigments, mineral: Iron oxides, processed	1,550	(¹)
Precious and semiprecious stones, except diamond, natural value, thousands	$237	$326
Pyrite, gross weight	106,585	37,198
Sodium compounds: Caustic soda	41,573	(⁶)
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	2,720	4,673
Worked	464	573
Dolomite, chiefly refractory grade	271	(⁵)
Calcareous stone, n.e.s	986	904
Gravel and crushed rock	3,312	2,163
Sand, excluding metal bearing	84,869	102,688
Sulfur, elemental, other than colloidal	161,781	68,784
Talc, steatite, soapstone, pyrophyllite	1,648	(⁵)
Other:		
Crude	577	135,724
Slag, dross, and similar waste, not metal bearing	2,959	3,127
Oxides and hydroxides	191	101,435
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	742	1,699
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	4,553	NA
Coal, including briquets:		
Anthracite and bituminous coal	571,474	386,319
Briquets	193	NA
Coke and semicoke	33,315	68,733
Peat, including peat briquets and litter	1,203	1,981
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	86,245	69,282
Refinery products:		
Gasoline, including natural do	441	532
Kerosine and jet fuel do	1,972	1,723
Distillate fuel oil do	2,442	1,035
Residual fuel oil do	4,660	4,107
Lubricants do	408	456
Other:		
Liquefied petroleum gas do	291	377
Mineral jelly and wax	9	9
Pitch and pitch coke do	79	79
Unspecified[7] do	713	893
Total do	11,015	9,211
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	4,496	NA

NA Not available.

[1] Included in "Other oxides, hydroxides, peroxides of metals."

[2] Included in "Other base metals including alloys, all forms, n.e.s."

[3] Included in "Other ores and concentrates."

[4] Includes pumice, emery, natural corundum, etc., if any.

[5] Included in "Other crude nonmetals."

[6] Included in "Other oxides and hydroxides."

[7] Includes petroleum coke, bitumen and other residues, and bituminous mixtures, n.e.s.

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COMMODITY REVIEW

METALS

Alumina and Aluminum.—Greece was virtually self-sufficient in alumina and aluminum and was an important exporter of bauxite. Aluminium de Grèce S.A. (AG), established by the French firm Pechiney in 1960, operated the only alumina-aluminum production facility in Greece, at Distomon, Boeotia. AG gets its bauxite from both independent and affiliated mining companies. It supplies domestic aluminum fabricators with nearly all their annual aluminum ingot requirements. (AG's aluminum ingot processing in 1979 totaled an estimated 145,000 tons.) Although AG is obliged to sell 15% of its aluminum production to the Greek market at export prices (rather than at the high protected domestic price), the Government asked the firm to increase this amount in 1979 to 20% to help aluminum fabricators lower costs and thus make their products competitive. AG complied with the Government's request.

AG had an annual capacity of 500,000 tons of alumina and 150,000 tons of aluminum. In January 1976, AG announced plans (which were subject to Government approval) to invest $100 million[3] to raise its annual alumina production capacity to 600,000 tons by 1980. Plans were for the entire new additional alumina output to be exported. AG expected to spend $40 million of this new investment to purchase foreign equipment. However, Government approval was not obtained in 1979 for expanding the alumina facility. But AG did obtain permission to spend $13.2 million for improved production, better working conditions, and to save energy.

Bauxites Parnasse Mining Co. S.A., of the Eliopoulou-Kyriacopolou Group, planned to construct an alumina production plant with a capacity of 600,000 tons per year. This investment was being cosponsored by the HIMIC and was approved by the Greek Government in March 1976. At the end of 1979, the sponsors were seeking foreign participation (which was not to exceed 49% equity participation), but no substantial progress had been made, principally because of the sponsors' insistence that the foreign participants guarantee a secure market for the plant's production. Meanwhile, there were intergovernmental talks at the ministerial level with the U.S.S.R., Poland, Bulgaria, Libya, and Iraq aimed at finding a possible long-range market outlet for the plant's alumina.

Bauxite.—During 1978 and 1979, Bauxites Parnasse, Greece's leading bauxite producer and exporter (1 million tons annually), and major supplier to AG (450,000 tons annually), continued to expand its underground mining facilities. Bauxites Parnesse's goal was to reach an output of 1.5 million tons annually by 1982. The company projected that by that time, half of its ore would come from underground. A Swedish firm, WP-System AB, a subsidiary of Granges AB, provided know-how throughout 1978 and 1979 for underground mining technology and training. In 1979, Bauxites Parnasse selected an Austrian consultant to aid in the restoration of the landscape at its depleted opencast mines and to program in advance appropriate land restoration for new opencast mines.

Eleusis Bauxite Mines, Mining-Industrial & Shipping, Inc. (Scalistiri Group), was the country's second largest producer (capacity: 720,000 tons per year), with mines near Eleusis, Lamia, Itea, and Kymi. The firm completed a heavy-media separation unit at Eleusis for treating an additional 2[illegible] tons per year of high-lime bauxite and tailings and put the unit onstream in June 1978. A second similar unit is under construction at Lamia. The firm also operates AG's Delphi Bauxites S.A. mines, which produce about 200,000 tons per year. (This production is included in the figure shown above for the capacity of Eleusis Bauxite.)

Greece as a whole produces over 3 million tons of bauxite annually (average content 54% to 65% Al_2O_3), of which 75% is exported and the remainder is consumed locally (primarily by the AG aluminum smelter at Distomon).

Chromite.—An intensive chromite exploration program, which was started in mid-1976 by IGME and GEMEE, continued at Vourinos Mountain, near Kozáni. Measured reserves reportedly amounted to 1 million tons (20% Cr_2O_3 content); additional probable reserves were estimated at 2 million tons; and there were indications of an additional 3 million tons in reserves. Exploration continued through 1979, and a 2,000-meter-long adit driven at Skoumitsa reached the ore body that was anticipated there.

Exploration was continuing at this site for the purpose of measuring the reserves, and although the research agencies had not yet completed exploration, the combined measured, probable, and indicated reserves were estimated at about 3 million tons (17% Cr_2O_3 content). IGME was also continuing exploration at Vourinos, outside Skoumitsa, and had reportedly located another 1-million-ton reserve.

During 1979, GEMEE transferred ownership of its mines and mining concession to the newly formed Hellenic Ferro Alloys.

The Government continued to give a high priority to the development of chromite facilities. At the end of 1978, a decision was made to establish a ferrochrome industry by 1982, to be undertaken jointly by the Government-sponsored HIMIC and ETVA. The Finnish firm Outokumpu Oy completed a feasibility study for HIMIC early in 1978. A plant projected to cost $30 million was planned, with production targeted at 30,000 tons of high-carbon ferrochrome per year, using 50,000 tons annually of chromite concentrate. The plant was expected to employ 120 persons. Several followup proposals, including some from abroad, were being evaluated by HIMIC. It was expected that a decision on the award would be made before the end of 1980.

Iron Ore.—In 1979, IGME continued exploration work on previously worked deposits on the island of Serifos, where remaining reserves were estimated at about 40 to 50 million tons having an average iron content of 25%. GEMEE planned to continue the work on Serifos in 1980, with drillings totaling 10,000 meters. Laboratory analyses and beneficiation tests of the ore were planned to follow to determine specific characteristics of the deposits and to evaluate whether these deposits can be worked economically and beneficiated for the purpose for which they are needed.

Lead and Zinc.—During 1978 and 1979, the Greek Government was keen on establishing a lead and zinc metal industry based on the indigenous mixed sulfides and beneficiated calamine (smithsonite) of northern Greece. An investment estimated at about $150 million for this industry was planned, including a smelter at an undetermined location. It was projected that the smelter, when completed, would have an annual production capacity of 70,000 tons of zinc and 40,000 tons of lead metal. To make the project more economically viable, planners studied the possibility of using the pyrite included in the mixed sulfides to establish a sulfuric acid unit with an annual production capacity of 150,000 tons. A 600-man labor force for the entire lead and zinc project was anticipated. However, at year end, no decision was made public on the sulfuric acid unit.

ETVA and HIMIC were examining the project's possibilities, and in 1979, ETVA requested the British firm Imperial Smelting and the West German firm Stolberg Consulting to do a feasibility study. The study, scheduled for completion before the end of 1980, was to be based on current international market conditions, prices, and available ore reserves. The decision on whether to go ahead with the project will rest with the Ministry of Industry. The Imperial Smelting process which gives as coproducts lead metal and zinc metal, was considered to be the most economic one for this project.

Besides planning for a smelter, Greek authorities were also making efforts to discover new reserves and assess the existing lead and zinc reserves on the national territory.

Early in 1979, IGME conducted drillings on Thassos and located zinc carbonate (smithsonite, or calamine) reserves. IGME's laboratory tests on beneficiation methods for these deposits were successful. The Imperial Smelting process requires an increased quantity of zinc concentrate; therefore the Greek authorities were examining the possibility of using the beneficiated calamines to meet the added zinc concentrate requirements for this process. In August 1979, IGME was also successful in locating mixed sulfide deposits on Thassos Island and was continuing its exploration for sulfides in other areas of Greece, particularly in the north, where prospects were considered good. Meanwhile, GEMEE, which has mining concessions containing lead and zinc in northeast Chalkidiki, was seeking funding from the European Economic Community (EEC) to conduct research on its concessions.

Nickel.—Larco S.A. (Bodossakis Group) at the end of 1978 completed an expansion program costing $68 million at its Euboea and Boeotia facilities, thereby increasing annual production from 15,000 tons to 27,000 tons of nickel. In 1979, the company gradually started up the new installations, conducted test runs, and made all necessary modifications for full operation, which was planned for 1980. The new plant had a Krupp rotary kiln and equipment from France, including an electric furnace constructed by French engineers. Larco also installed new pollution control facilities at its smelter. New mine equipment (principally from the United States) raised the output of laterite ore to 3 million tons per year. In 1979, Larco completed a new crushing facility (with a dust-collection system) near its

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mines. The new facility is located 460 meters above sea level and is linked to the Politika port by an 8-to-10-kilometer closed-top ore conveyor. Within the next 3 years, Larco planned to reorganize its blending and stockpiling installations at Politika by installing additional conveyor belts, a new reclaimer, and a new stacker.

Two nickel projects were shelved pending an improvement in world nickel market conditions and the availability of an adequate electric power supply. These projects were 1) Larco's long-range plan to raise its nickel capacity to 40,000 tons per year, at an estimated cost of $170 million; and 2) Eleusis Bauxite's plan to build a 10,000-ton-per-year nickel plant.

Steel.—A new cold rolling mill, which was being designed to produce steel sheet suitable for car bodies, was under construction at Eleusis during 1979. Owned by Halyvourgiki, the new plant's annual capacity was projected at 400,000 tons of good-quality products. A new addition was expected to increase the combined annual steel capacity of Halyvourgiki to 1.5 million tons. In addition, plans were prepared for a 250,000-ton-per-year plant to produce steel bars, rods, sections, and stainless steel near Thessaloniki; and for a miniplant for the production of bars at Patres. Hellenic Steel examined possibilities for expansion of its production capacity for hot rolled products from 400,000 tons to 750,000 tons.

NONMETALS

Asbestos.—The foundation stone for a new $65 million asbestos mine and processing plant was laid at the end of April 1978 in Zidani, near Kozáni, in north-central Greece. It was anticipated that the mine and plant would have a capacity of about 100,000 tons of fiber per year and would employ 300 persons; completion was scheduled for 1980. ETVA was providing financing for the project, which was to be carried out by EVTA-controlled Asbestos Mines of Northern Greece, Mining Societe Anonyme (MABE). Plans were for shares of MABE to ultimately be available for purchase by the public, but ETVA was unsuccessful in obtaining foreign participation.

At yearend 1978, the work of building roads, bringing in power, and erecting housing was completed under the supervision of Kilburn Engineering Ltd. of Canada; and in 1979, actual construction of the plant began. Reserves at the mine are adequate to support an output of 100,000 tons per year of fiber for 25 years. An opencast mine was planned with a final open pit diameter of 1,000 meters. The deposit is located within an ultrabasic rock intrusion into a series of gneiss and schists overlain by marble and was discovered in 1936. Two U.S. companies, the Kennecott Copper Corp. and Cerro Corp., were involved at different times in exploration and operation of pilot plants. ETVA acquired the Zidani property from Cerro Corp. in January 1977. At the mine site, stripping operations were underway during the last 6 months of 1979.

MABE ordered most of the pit and plant equipment from manufacturers from the United States, Canada, the United Kingdom, and the Republic of South Africa. Pollution control equipment was ordered from the British-Canadian firm Tilghman Wheelabrator Corp. The expenditure for foreign equipment and for engineering studies to be conducted abroad was expected to amount to 55% ($37.5 million) of the total investment. MABE planned to export 80% of the plant's annual output of asbestos fibers and was already in contact with foreign customers.

ETVA reportedly planned to establish an independent Greek company in 1981 to handle exports and sales of the asbestos fibers produced at Zindanion. It was reported that foreign firms specializing in the asbestos trade would be invited to participate in the company.

Barite.—The Silver and Barite Ores Mining Co. (Eliopoulou-Kyriacopoulou Group) had under consideration the establishment by 1981 of a 100,000-ton-per-year beneficiation facility for low-grade barite deposits on Milos Island. The firm is a major producer and exporter of industrial minerals, including bentonite (capacity 350,000 tons), kaolin, perlite, and barite. No decision on this plant was announced during 1979.

Cement.—Compared with the previous year's sales, estimated domestic sales of cement were up 6.5% in 1979 (to 6.4 million tons), reflecting increased building activity. All cement exports were made in free currencies and almost all the exported cement was transported in Greek-owned vessels. Among European cement exporters, Greece ranked second after Spain. Four cement companies shared the country's production capacity, which amounted to 11.9 million tons per year.

In the fall of 1978, cement shortages were reported, especially in the Attika area. In part, this was due to a shutdown in September 1978 of quarries in the Athens area for environmental reasons.

The Titan Co. obtained Government approval during 1977 to invest $44 million to build an additional 1-million-ton-per-year cement plant at Kamari, Boeotia; in 1979, the plant was completed. In December 1979, Heracles General Cement Co. obtained Government approval to establish a 1.5-million-ton-per-year plant at Milaki, near Aliveri in Euboea. Halyps S.A. completed the installation of a 600,000-ton-per-year rotary kiln that replaced three obsolete ones. The kiln's first output was expected in 1980. During 1978 and 1979, projects were in the early stages of planning for expansion of the Halkis Cement Co. and for construction of a new 1-million-ton-per-year cement plant for the island of Crete.

Magnesite.—The Financial-Mining-Industrial and Shipping Corp. (FIMISCO) Scalistiri Group, the country's major magnesite and refractory producer, shelved a project to manufacture refractory magnesia from seawater and dolomite. However, FIMISCO did build a new plant in Euboea for preconcentrating magnesite tailings and low-grade ores. The capacity of the plant was 400 tons per hour, and technology was developed by FIMISCO to raise the magnesite content of the treated product from 5% to 10%. Grecian Magnesite Ltd., with mines at Gerakini and Chalkidiki, purchased its third 180-ton-per-day rotary kiln from Smidth of Denmark for the production of deadburned magnesite and installed it in 1979.

Greece remained a net exporter of magnesite and magnesite refractories, but a slowdown in European steel production disrupted the Greek companies, especially those that had expanded during the boom years.

Marble.—During 1978, GEMEE obtained all the shares of the Hellenic Marble Industrial and Commercial Co. S.A., a company formerly belonging to ETVA. GEMEE was investing $1.6 million in new quarrying and processing machinery and planned to export processed marble in thin slabs. During 1978, Hellenic Marble produced semiprocessed marble for the local market and exported unprocessed marble. No major events relative to the Greek marble industry were reported during 1979.

Phosphate.—In 1976,IGME discovered extensive phosphate deposits at Delvinaki, near Ioannina, Epirus, that exceeded 1 billion tons. But these deposits are of poor quality (their phosphate content ranges from 8% to 28%), and their beneficiation presents serious problems. IGME reported that these deposits were of many different types and that two of the types were present in substantial quantities. In 1979, IGME developed a laboratory method for beneficiating one of these two phosphate types, francolite, which has a P_2O_5 content of 13% to 20%. The Epirus deposits of this type amount to about 10 million tons. IGME planned to conduct a pilot-plant test in 1980. It was anticipated that development of the Epirus phosphates would result in considerable foreign exchange savings for Greece, which annually imports $25 to $30 million worth of phosphate.

Quartzite.—In 1978, Hellenic Industrial Minerals S.A. (ELVOIR) (51% controlled by GEMEE), inaugurated a 70,000-ton-per-year processing plant (including crushing, screening, and washing facilities) at its new quartz quarries 40 kilometers northeast of Thessaloniki. The quartz extracted from these quarries is 99% pure and is suitable for the production of metallic silicon. During 1978 and 1979, the second and third years of its operation, ELVOIR exported 26,000 tons of processed material, principally to Sweden, but also to Norway, Italy, and Switzerland. In 1979, ELVOIR was examining the feasibility of installing a milling plant to produce powder from processed tailings for various local uses.

Salt.—During 1978, HIMIC established the firm, Messolonghi Saltworks S.A., to expand the saltworks at Messolonghi from an annual capacity of 80,000 tons to 450,000 tons. HIMIC, which controls 70% of the shares of the new company, planned to invest $817 million. Tecnosel S.A. of Switzerland prepared the engineering study and was planning to undertake part of the project's supervision. During 1979, work on the Messolonghi expansion project continued. It was projected that upon completion the saltworks would supply 120,000 tons per year of salt to a petrochemicals complex under construction by the Government of Greece in the Messolonghi area. Previous plans by the Government to recover chemicals from saltwork bitterns and to produce soda ash are in abeyance because the results of a feasibility study conducted by the Catalytic International of London were negative.

MINERAL FUELS

Lignite.—Lignite continued to be the country's only exploited domestic mineral fuel. Lignite was mined and used by the PPC to fuel power stations at Aliveri (Euboea), Ptolemais (near Kozáni), and Megalopolis (central Pelaponnesus).

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In 1978 and 1979, PPC began preliminary work to open the untapped Ptolemais South Field (where deposits were estimated at 700 million tons). Meanwhile, the West German technical firm Otto Gold prepared an engineering study for development of this field. It was hoped that the field would produce sufficient lignite to supply seven more 300-megawatt power units at Kardia (five of which were planned to be located at Agios Demetrios, a newly designated location near Kardia) in the 1980's.

During the year 1979, PPC began infrastructure work on the installation of a 12-kilometer conveyor belt to transport the overburden. This conveyor belt, scheduled for installation in 1980, was to be constructed and installed by the Greek firm, Metal Constructions of Greece S.A. (METKA), using West German technology. In 1978, METKA was also given a contract to install a second conveyor system of the same length to transport lignite. The bucket-wheel excavators and stackers, which were ordered in 1976 from West German and East German firms (Krupp and Machinen-Export), were scheduled to be delivered in 1980. In 1978, PPC also accepted an engineering study prepared by West German consultant Hanz Goergen recommending methods for developing the Kiparisson and South Horemi fields at Megalopolis to fuel the new unit and to increase annual lignite production at Megalopolis from 9 million tons to 14 million tons. However, tenders issued in 1978 for mining equipment and the new unit were cancelled and were to be reissued in 1979. At Aliveri (the only underground lignite mine) lignite deposits were almost exhausted, and PPC expected to close the mine by 1982.

At Amynton, intensive exploration carried out by PPC and IGME since 1975 has verified the existence of important lignite deposits. (The 1978 and 1979 revised reserve figures show 438 million tons of measured reserves, of which 250 million are mineable, with a calorific value of 1,950 calories per kilogram.) During 1978, PPC completed a preliminary study of the project and again selected the West German consultant Hanz Goergen to do an engineering study for the development of a mine to produce 7 million to 7.8 million tons of lignite annually.

During 1978, PPC, in cooperation with IGME, continued its search for lignite. Countrywide, 247 lignite exploration holes were drilled for a total depth of 25,934 meters. A 200-million-ton deposit of lignite was measured at Perdika-Komnion in 1979, of which 50 million tons are considered mineable. In 1979, PPC invested $141 million for the development of lignite mines and $3.8 million for lignite exploration.

Petroleum and Natural Gas.—Greece did not produce crude oil or natural gas in 1978 or 1979; all of the country's demand was met through imports. Exploration, however, continued onshore in northern Greece and on some of the islands and offshore near the island of Thassos. A small oilfield was discovered in 1975 near Thassos, and preparations for offshore production were underway during 1978 and 1979.

Four petroleum refineries with a total capacity of 20 million tons were in operation in Greece during 1979. The largest refinery was the Motor Oil (Hellas) Corinth Refineries, Corinth, with a crude oil capacity of 7 million tons per year.

Uranium.—During 1979, the Democritus Research Center, which has an annual uranium exploration budget of about $1.1 million, continued its exploration program in eastern Macedonia and Thrace. The first phase of explorations began with a carborne scintillometer survey of western Macedonia and Epirus. No exploitable deposits were found, but results were encouraging; and more information was expected to be available by 1981 or 1982. In 1978, IGME also started uranium exploration in Epirus under a joint program with Democritus. A lignite deposit at Marameva, Serres, was found to contain about a possible 2,000 tons of U_3O_8; work to develop an extraction process was expected to start in 1980.

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[1] Principal source of information for this chapter was State Dept. Airgram A-8, U.S. Embassy, Athens, January 21, 1980, drafted by D. Kirkini.

[2] Physical scientist, Branch of Foreign Data.

[3] Where necessary values have been converted from Greek drachmas to U.S. dollars at the rate of US$1.00=42.00 drachmas.

The Mineral Industry of Hungary

By George Rabchevsky[1]

The overall growth of the Hungarian national income in 1978 was less than 4%, one percentage point below the plan; with industrial output expanding by over 5%.[2] Metallurgy and mining and light industry output grew by only 2% to 3%. Among the centrally planned economy countries, Hungary ranked statistically behind the German Democratic Republic (GDR) and Czechoslovakia in per capita income. Total investment in 1978 amounted to Ft197 billion,[3] considerably exceeding the planned level.

Also, Hungary, in 1978, experienced a record trade deficit of over US$1.5 billion; imports increased almost 13%, while exports grew only 1%. Trade with COMECON[4] grew more slowly than trade with the rest of the world and the share of COMECON in Hungary's total trade continued its slow decline, to just over 50%.[5] The most important development in the United States-Hungarian trade was the signing in 1978 of a bilateral trade agreement extending Most Favored Nation (MFN) tariff treatment.

Hungary's poor economic performance persisted in 1979. The national income, for example, rose only by 1.6% to Ft550 billion, instead of the planned 3% to 4%, the lowest growth since 1945, and prices rose by 9%.[6]

Capital investment in 1979 included: the Paks nuclear powerplant (Ft5.5 billion), the Belapatfalyi cement plant, the Lenin iron and steel combine (Ft2.5 billion), the Deak bauxite mine, oil and gas exploration, and aluminum industries. The 1979 planned State Budget income amounted to Ft407.2 billion and the Budget expenditures, Ft410.8 billion, resulting in a deficit of Ft3.6 billion. The expenditures of the Ministry of Metallurgy and Machine Industry were set at Ft113.2 million and Ft863 million for projects at the Central Geological office.[7]

The planned 1980 target for national income is set to rise by 3% to 3.5% and industrial growth is to be 3.5% to 4%. Investment in 1980 is planned to decrease significantly (4% to 5%) and the domestic and foreign trade deficit is not expected to be changed much from the previous year. Owing to the poor performances in the previous 2 years, however, the planners have not set definitive targets in most areas for the next 5 years.

PRODUCTION

The Hungarian production of mineral commodities stagnated in 1978 and 1979 and, except for the nonmetals and mineral fuels, the production plans were not fulfilled. Even though the output of crude oil showed a slight increase, the production of natural gas decreased. The overall production of the metallurgy, mining, and light industry increased by 2% to 3% over the 1978 year.[8]

In 1978, 10 large mineral projects were initiated, 11 were completed in 1979 and, of those started in 1978 and 1979, 2 will be completed in 1980. Most of those projects involved modernizations and improvements in existing facilities, such as the Szeged oil and gas complex, the Tisza oil refinery, steel production at the Ozd metallurgical works, the Lenin steel plant, construction of the Recsk copper mine, the Danube power

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stations II and III, the Adriatic crude oil pipeline, and others.[4] New bauxite mines have been opened in 1979 and a substantial increase in the production of alumina is being planned. The Ajka plant is to increase its production of alumina in the future and the Szekesfeherver aluminum rolling mill was under expansion. Hungary also initiated extensive exploration and extraction programs for coal between the Gryöngyos and Füzesabomy areas.

Hungary continued to lead other East European countries in the output of bauxite; most other mineral commodities, however, were imported, including crude oil and refinery products. Because of the depletion of readily accessible reserves, the drilling for oil and gas proceeded up to 6,000 meters in depth. According to recent Hungarian sources, the value of mineral reserves in the country was estimated at about Ft600 billion.

In 1978, Hungary reorganized its resources, research and development activities and found the Central Mine Development Institute (KBFI). In addition to the domestic exploration program, Hungary also participated in geological projects in Mongolia, Cuba, and Iraq and a number of the COMECON countries. The joint prospecting program of the COMECON countries is under the control of the so-called Coordination Center (KOC), the Intermorgeo and Intergeotechnika being the actual working groups of the Center. Furthermore, Geoinform is an organization whose purpose is to insure exchange of mineral information among the COMECON members.

Table 1.—Hungary: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Bauxite, gross weight .... thousand tons	2,918	2,949	2,899	3,000
Alumina, gross weight .... do	732	783	782	800
Metal, primary	70,499	71,335	71,359	71,100
Copper:				
Mine output, metal content	[r]1,300	1,000	500	300
Metal:				
Smelter, secondary	[r]1,100	800	300	100
Refined, including secondary	10,600	12,100	13,100	12,200
Gold, mine output, metal content[e] .... troy ounces	155	115	60	60
Iron and steel:				
Iron ore, gross weight .... thousand tons	602	525	534	520
Metal:				
Pig iron:				
For steel industry .... do	2,111	2,175	2,252	2,300
For foundry use .... do	110	111	78	80
Total .... do	2,221	2,286	2,330	2,380
Ferroalloys:				
Ferrosilicon[e]	6,900	6,800	7,600	7,700
Other[e]	2,800	2,900	2,300	2,300
Total	[r]9,700	9,700	9,900	10,000
Crude steel .... thousand tons	3,652	3,723	3,877	3,900
Semimanufactures, rolled only .... do	2,857	3,077	3,188	3,200
Lead:				
Mine output, metal content	900	1,200	1,000	1,100
Metal, refined, secondary	300	200	300	300
Manganese ore:				
Run of mine[2]	165,074	160,637	156,181	150,000
Concentrate	125,000	120,000	114,000	105,000
Silver, mine output, metal content .... thousand troy ounces	82	39	39	30
Zinc:				
Mine output, metal content	2,200	2,800	2,600	2,500
Metal, smelter, secondary	655	600	[e]600	600
NONMETALS				
Cement, hydraulic .... thousand tons	4,298	4,620	4,764	4,800
Clays:				
Bentonite:				
Raw	71,148	80,003	82,211	88,000
Processed	51,012	51,636	56,076	56,100
Kaolin:				
Raw	85,733	71,455	68,199	67,000
Processed	6,215	6,000	6,859	7,000

See footnotes at end of table.

Table 1.—Hungary: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Lime, calcined ---- thousand tons	732	743	740	740
Nitrogen, N content of ammonia ---- do	[r]703	729	746	750
Perlite	96,180	103,270	92,630	93,000
Pyrite, gross weight[e]	7,000	7,000	7,000	7,000
Refractory materials, n.e.s.:				
Chamotte products ---- thousand tons	169	171	163	160
Chrome magnesite products ---- do	47	44	42	41
Sand and gravel:				
Gravel ---- thousand cubic meters	12,625	12,890	13,821	14,500
Sand:				
Common ---- do	471	288	279	280
Foundry ---- thousand tons	687	732	787	790
Stone:				
Dimension, all types ---- do	4	3	2	2
Other:				
Dolomite ---- do	1,126	1,173	1,171	1,175
Limestone ---- do	8,038	8,263	8,598	8,700
Quartzite ---- do	42	34	31	31
Sulfur:				
From pyrite[e]	3,000	3,000	3,000	3,000
Byproduct, elemental, all sources	7,778	8,004	8,633	8,700
Total	10,778	11,004	11,633	11,700
Sulfuric acid	617,208	632,032	643,795	650,000
Talc	16,000	16,000	17,500	17,500
MINERAL FUELS AND RELATED MATERIALS				
Carbon black[e]	4,000	5,000	5,000	5,000
Coal:				
Bituminous ---- thousand tons	2,934	2,925	2,954	3,000
Brown ---- do	14,779	14,433	14,302	14,000
Lignite ---- do	7,544	8,096	8,414	8,600
Total ---- do	25,257	25,454	25,670	25,600
Coke:				
Coke oven:				
Metallurgical ---- do	604	586	604	610
Other ---- do	169	[e]170	[e]170	170
Total ---- do	773	756	774	780
Gashouse ---- do	203	[e]190	[e]185	180
Grand total ---- do	976	946	959	960
Fuel briquets ---- do	1,018	1,105	1,169	1,180
Gas:				
Manufactured ---- million cubic feet	22,531	20,376	19,811	19,000
Natural, marketed ---- do	214,783	253,464	259,420	224,000
Natural gas liquids:				
Natural gasoline ---- thousand 42-gallon barrels	1,148	1,420	2,380	2,400
Liquefied petroleum gas ---- do	1,740	[e]2,150	[e]3,000	3,000
Peat, agricultural use[e] ---- thousand tons	70	70	70	70
Petroleum:				
Crude:				
As reported ---- do	2,142	2,191	2,198	2,200
Converted ---- thousand 42-gallon barrels	16,343	16,717	16,771	16,405
Refinery products:[3]				
Gasoline, including naphtha ---- do	10,038	9,928	11,475	12,500
Kerosine and other light distillates[4] ---- do	7,626	6,107	6,285	6,400
Distillate fuel oil ---- do	25,767	25,685	26,968	27,500
Residual fuel oil ---- do	23,370	23,543	24,549	25,000
Lubricants ---- do	1,317	1,228	1,121	1,200
Other:				
Liquefied petroleum gas ---- do	1,067	[e]1,100	[e]1,100	1,100
Asphalt and bitumen ---- do	3,600	4,006	4,145	4,200
Paraffin and petrolatum ---- do	200	198	208	210
Total ---- do	72,925	71,796	75,851	78,110

[e] Estimate. [p] Preliminary. [r] Revised.

[1] In addition to the commodities listed, diatomite, gypsum, and a variety of other crude construction materials such as common clays are produced, but available information is inadequate to make reliable estimates of output levels.

[2] 18%-20% Mn.

[3] Excludes refinery fuel and losses.

[4] Data derived by subtracting reported motor gasoline and white spirit data from reported light refinery products total.

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TRADE

Hungary's trade deficit in 1978 was Ft60.2 billion, 50% over the planned target and a record high to date. Thus, early in 1978, the government implemented a number of macroeconomic measures designed to slow the growth of the domestic economy and to restore trade equilibrium. Consequently, overall exports in 1979 increased by 17% and imports by 3%. The foreign trade balance was thus improved in 1979, especially in the trade with the dollar sector.

In 1978 and 1979, Hungary had trade agreements with about 145 countries. Over 55% of Hungary's foreign trade was conducted with centrally planned economy countries, especially the COMECON members. Almost 90% of Hungary's energy and 70% of its raw materials were imported from those countries.[10] Hungarian exports to those countries included perlite, dolomite, sand, and manganese oxide. In 1979, Hungarian exports to the U.S.S.R. rose 8% and imports by 12% representing 33% of the total foreign trade turnover. Because of the completion in 1979 of the Orenburg gas pipeline, Hungary received three times more natural gas than previously. Iron ore was also imported from the U.S.S.R. In addition, the U.S.S.R. provided technical and financial aid to Belapatfalva cement plant, delivered an oxygen converter to the Danube iron works, and worked on the Paks nuclear power station.[11] Overall, the U.S.S.R. provided Hungary with a substantial amount of its petroleum, electric power, natural gas, and raw materials, including minerals such as iron and manganese ore, pyrite, asbestos, aluminum, other nonferrous metals, phosphate,andsulfur. The Soviet petroleum exports made up 75% of Hungary's consumption. The 1980 Hungarian import agreement with the Soviet Union included 7.5 million tons of crude oil, 3.8 billion cubic meters of natural gas, as well as electricity, and iron ore.[12]

The GDR in 1978 and 1979 remained Hungary's second largest centrally planned economy trading partner. As before, machines and equipment made up 70% of the trade. Hungary's COMECON trade increased by 6.9% in 1979, of which exports rose by 8.1% and imports by 5.9%, slightly below the planned levels.[13]

In 1978 and 1979, approximately 38% of total Hungarian foreign trade was conducted with the developed market economy countries and 7% with the developing countries. Of the overall foreign trade with the market economy countries, in 1978 and 1979, trade with the member countries of the European Economic Community (EEC) remained about 60%. In 1978, the EEC introduced trade restriction on the Hungarian steel and other exports, thus supposedly contributing to the decline in Hungarian exports. Hungarian imports from those countries fell slightly (by about 0.2% of US$1 million) in 1979, while exports rose 28%, thus substantially decreasing Hungary's trade deficit with these countries from an estimated US$1.1 billion in 1978 to US$435 million in 1979. This was the result of measures taken by the Hungarian government to reduce their imports, to slow economic growth, to lower investment, and to increase exports. The increase in exports consisted mostly of metallurgical products and chemicals.[14] In 1978 and 1979, the Federal Republic of Germany was Hungary's largest market economy trading partner, accounting for 10% of total Hungarian foreign trade.[15]

In 1978, Hungary was awarded the most-favored trading status by the United States, subject to annual renewal.[16] As a result, reportedly imports of Hungarian goods in 1979 by the United States increased by 64% over the 1978 level, reaching a record high of US$112.2 million. Overall United States-Hungarian trade in 1979 increased by 14% over the 1978 level. The year 1979 was also the first year in which the U.S. trade agreement and the textile trade agreement with EEC went into full effect and played considerable roles in producing Hungary's good results in its trade with Western markets. The anticipated growth in United States-Hungarian trade during 1980 is 10% to 15%.

Of special interest was the inauguration in 1978 in New Jersey of the Hungarian Tungstram electric bulb factory. It is the first factory jointly owned by Hungarian and U.S. citizens in the United States and probably also the first joint enterprise by a centrally planned economy country on U.S. soil. The enterprise is headed by a board of four directors of which two are Hungarian and two American, with 51% of the shares in American ownership and 49% in Hungarian. By 1979, a second joint United

States-Hungarian company was operating in the United States, the Tramsmed Ray, and one wholly Hungarian-owned subsidiary of Medipex (Foreign Trade Enterprise for Pharmaceutical Products). There was one joint company operating in Budapest, the Radekor/Radelkis and Corning Glass Company, manufacturing electrochemical instruments.[17] Hungary was also evaluating the U.S. market for export of its bauxite processing technology, joint construction in Hungary of alumina plants, oil exploration, and coal and copper mining.

Table 2.—Hungary: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:[2]			
Bauxite	584,319	601,203	Czechoslovakia 330,668; East Germany 189,998.
Alumina:			
Hydrated	6,309	8,605	Finland 8,588.
Calcined	706,539	688,002	U.S.S.R. 394,183; Poland 140,766; Austria 101,432.
Metal including alloys:			
Scrap	17,688	12,128	Italy 7,874; Austria 2,584; West Germany 1,581.
Unwrought	69,580	79,658	Poland 25,937; Czechoslovakia 12,157; Yugoslavia 7,081.
Semimanufactures	37,087	31,385	East Germany 8,147; Czechoslovakia 3,400; Cuba 2,793; Sweden 2,550.
Bismuth metal including alloys, all forms	22	--	
Cadmium metal including alloys, all forms	--	15	All to West Germany.
Chromium oxide and hydroxide	218	259	Turkey 126; Italy 71.
Cobalt oxides and hydroxides	--	42	All to Turkey.
Copper:			
Matte	141	42	All to Switzerland.
Metal including alloys:			
Scrap	2,340	7,254	Austria 4,316; West Germany 1,972.
Unwrought	6,994	3,466	West Germany 2,074; United Kingdom 903.
Semimanufactures	3,584	6,331	Yugoslavia 3,425; West Germany 1,774.
Iron and steel metal:			
Scrap thousand tons	[3]71	[3]42	Italy 26; West Germany 9.
Pig iron[2] do	116	47	Poland 17; Romania 15; Yugoslavia 8; Austria 7.
Ferroalloys do	[3]1	[3]1	Mainly to Austria.
Steel, primary forms[2] do	29	5	Poland 1; Yugoslavia 1.
Semimanufactures:[2]			
Bars, rods, angles, shapes, sections do	786	704	U.S.S.R. 108; West Germany 80; Yugoslavia 80; Iran 64.
Plates and sheets do	343	256	Yugoslavia 30; Poland 28; West Germany 27.
Hoop and strip do	24	22	Romania 9; Yugoslavia 5; Lebanon 2.
Wire and rod do	29	25	Iran 6; Yugoslavia 4; Austria 2; Egypt 2.
Tubes, pipes, fittings do	66	78	Romania 12; U.S.S.R. 10; Finland 8.
Castings and forgings do	17	21	Bulgaria 5; Romania 4; Czechoslovakia 3.
Other do	28	25	West Germany 11; Czechoslovakia 3; Poland 3.
Total do	1,293	1,131	
Lead:			
Oxides	197	--	
Metal including alloys:			
Scrap	69	84	West Germany 44; United Kingdom 40.
Unwrought	675	1,067	Austria 1,027.
Magnesium metal including alloys, unwrought	120	--	
Manganese:			
Ore and concentrate[2]	37,961	49,649	Poland 41,087; Czechoslovakia 8,562.
Metal including alloys, all forms	37	--	
Molybdenum metal including alloys, all forms kilograms	11,000	400	All to West Germany.
Nickel:			
Matte and speiss	13	24	All to Turkey.
Metal including alloys:			
Scrap	344	216	United Kingdom 157; West Germany 48.
Unwrought	290	301	Austria 239.
Semimanufactures	248	190	Yugoslavia 183.

See footnotes at end of table.

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Table 2.—Hungary: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Platinum-group metals and silver:			
Ores and concentrates ---- value, thousands	--	$27	All to United Kingdom.
Waste and sweepings ---- do	$1,579	$300	All to West Germany.
Metals, unworked or partly worked:			
Platinum-group ---- do	$55	$91	Italy $87.
Silver ---- do	$477	$560	Switzerland $423; United Kingdom $108.
Tin metal including alloys:			
Scrap	35	20	All to United Kingdom.
Semimanufactures	NA	2	All to Indonesia.
Titanium oxides	460	307	Turkey 257; Austria 30.
Tungsten metal including alloys, all forms	1	3	Egypt 1; Indonesia 1.
Zinc metal including alloys, scrap	204	648	West Germany 326; Austria 322.
Other:			
Ores and concentrates	--	810	All to Yugoslavia.
Ash and residue containing unspecified nonferrous metals	14,991	23,783	Austria 15,271; Italy 4,920.
Oxides, hydroxides, peroxides	47	44	West Germany 20; Turkey 13.
Metals:			
Metalloids	391	163	All to Switzerland.
Base metals including alloys, all forms, n.e.s.	84	67	United Kingdom 38; West Germany 15.
NONMETALS			
Abrasives:			
Grinding particles[3]	8,291	7,905	West Germany 5,711; Romania 1,466.
Grinding and polishing wheels and stones	12	30	Turkey 16; Hong Kong 7.
Asbestos	3,266	2,592	Belgium-Luxembourg 1,541; West Germany 1,051.
Boric oxide and acid	--	30	West Germany 20; Yugoslavia 10.
Cement[3] ---- thousand tons	265	189	Yugoslavia 161; U.S.S.R. 17.
Clays and clay products:			
Crude:			
Bentonite[3]	19,400	14,156	East Germany 9,989; Poland 3,962.
Kaolin, crude[3]	7,724	7,025	Czechoslovakia 5,022; West Germany 2,003.
Other	2,799	6,356	West Germany 3,513; Switzerland 2,843.
Products:			
Refractory[3]	24,311	24,037	Romania 5,679; West Germany 3,051; Italy 2,919.
Nonrefractory	858	1,599	Austria 1,478; Denmark 68.
Diamond			
Gem, not set or strung ---- value, thousands	$130	$2	All to West Germany.
Industrial ---- do	$231	$2,135	Belgium-Luxembourg $2,131.
Diatomite and other infusorial earth	4,374	2,963	Austria 2,847.
Fertilizer materials:			
Manufactured:			
Nitrogenous ---- thousand tons	[4]414	[4]337	West Germany 42; Yugoslavia 39; Turkey 12.
Phosphatic ---- do	--	[4]105	NA.
Potassic	1,834	383	Italy 380.
Other, including mixed ---- thousand tons	[3]48	15	West Germany 14.
Ammonia[3]	110,311	75,861	Yugoslavia 44,271; Poland 22,781.
Graphite, natural	120	40	All to Yugoslavia.
Gypsum and plasters	--	22	All to Austria.
Mica, worked	5	2	All to Yugoslavia.
Pigments, mineral: Processed iron oxides	424	1,650	Yugoslavia 1,630.
Precious and semiprecious stones ---- value, thousands	--	$65	France $41; Italy $14.
Pyrite	--	936	All to West Germany.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	100	9,018	All to Yugoslavia.
Caustic potash	30	100	All to Turkey.
Soda ash	[4]300	[4]100	Yugoslavia 59; Sweden 20.
Stone, sand and gravel:			
Dimension stone	1,919	2,696	Switzerland 1,023; Austria 872.
Dolomite	--	358	West Germany 273.
Gravel and crushed rock[3]	171,374	248,453	Yugoslavia 209,345; U.S.S.R. 28,279.
Limestone	56,164	70,935	Yugoslavia 59,805.
Quartz and quartzite	3,483	3,222	All to Austria.
Sand, excluding metal bearing:[3]			
Industrial	30,235	39,550	Yugoslavia 27,291; Austria 7,025.
Construction ---- thousand cubic meters	601	399	Czechoslovakia 364.
Sulfur:			
Elemental	1,831	3,827	All to Austria.
Sulfuric acid, including oleum[3]	112,146	70,588	Yugoslavia 63,356; Romania 7,223.
Talc	180	90	All to Yugoslavia.

See footnotes at end of table.

Table 2.—Hungary: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Other:			
Crude[2]	97,738	91,353	Austria 25,180; East Germany 23,633; Yugoslavia 11,918.
Oxides of magnesium, strontium, barium	176	40	All to Yugoslavia.
Halogens	--	742	All to Austria.
Halide[2]	2,860	3,205	United Kingdom 1,800; Italy 555.
MINERAL FUELS AND RELATED MATERIALS			
Coal and briquets:			
Anthracite and bituminous coal	4,789	69	All to Austria.
Lignite[2]	56,138	37,460	Austria 21,860; U.S.S.R. 15,600.
Briquets[2]	7,149	290	Austria 269.
Coke, all types[2]	10,298	3,660	Yugoslavia 3,636.
Gas, natural[2] million cubic feet	358	667	Czechoslovakia 385; U.S.S.R. 282.
Peat and peat briquets[2]	2,622	3,537	Yugoslavia 3,322.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	[4]6,279	[4]11,163	NA.
Refinery products:			
Gasoline[2] do	496	1,258	West Germany 391; Austria 390; Yugoslavia 306.
Kerosine[2] do	200	364	U.S.S.R. 261; EastGermany 20.
Distillate fuel oil[2] do	1,805	612	Poland 395; U.S.S.R. 172.
Residual fuel oil[2] do	1,173	235	Austria 121; Vietnam 21.
Lubricants[2] do	1,485	287	Austria 224; Vietnam 21.
Other:			
Liquefied petroleum gas[2] do	1,061	1,543	Yugoslavia 661; West Germany 545; Austria 220.
Nonlubricating oils do	175	--	
Mineral jelly and wax[2] do	161	181	Yugoslavia 39; West Germany 36; Italy 27.
Bitumen and other residues[2] do	421	403	Nigeria 127; Austria 115.
Bituminous mixtures do	--	6	United Kingdom 4.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals[2]	79,938	73,590	Italy 39,082; Yugoslavia 17,270; Austria 7,941.

NA Not available.

[1] Owing to the lack of official trade data published by Hungary, this table should not be taken as a complete presentation of Hungary's mineral exports. Unless otherwise specified, data are compiled from trade statistics of individual trading partners, as well as the United Nations World Trade Annual, Walker and Co., New York.

[2] Official trade statistics of Hungary.

[3] United Nations. Quarterly Bulletin of Steel Statistics for Europe, New York.

[4] Statistical Yearbook of the Member States of the Council for Mutual Economic Assistance, Moscow. 1980.

Table 3.—Hungary: Apparents imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite	--	1	All from Switzerland.
Oxide and hydroxide	50	197	West Germany 100; United States 95.
Metal including alloys:			
Scrap	--	1	All from Austria.
Unwrought[3]	162,406	165,859	U.S.S.R. 147,482; Poland 17,500.
Semimanufactures[3]	7,725	8,717	East Germany 3,004; Romania 2,676.
Bismuth metal including alloys, all forms	2	--	
Cadmium metal including alloys, all forms	105	--	
Chromium:			
Chromite	17,380	17,140	U.S.S.R. 17,000.
Oxides and hydroxides	--	35	All from United Kingdom.
Cobalt:			
Oxides and hydroxides	25	11	All from France.
Metal including alloys, all forms	6	4	France 3.
Copper:			
Copper sulfate[3]	3,749	4,101	U.S.S.R. 4,000.
Metal including alloys:			
Scrap	1,114	4,824	West Germany 2,192; Belgium-Luxembourg 1,120.
Unwrought	[3]37,639	[3]32,888	Poland 2,445; Austria 1,836.
Semimanufactures	[3]11,267	[3]12,411	West Germany 1,290; Italy 677.

See footnotes at end of table.

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Table 3.—Hungary: Apparents imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Iron and steel:			
Ore and concentrate[2] thousand tons	4,258	4,200	U.S.S.R 4,086; India 54.
Roasted pyrite[2] do	228	265	Romania 147; U.S.S.R. 83.
Metal:			
Scrap do	2	[2]3	NA.
Pig iron[2] do	227	251	U.S.S.R. 250.
Ferroalloys[2] do	59	71	U.S.S.R. 44; Czechoslovakia 4; Poland 3.
Steel, primary forms[2] do	562	562	U.S.S.R. 369; Romania 51; Poland 42; Czechoslovakia 30.
Semimanufactures:			
Bars, rods, angles, shapes sections[2] do	260	221	U.S.S.R. 179; Czechoslovakia 13.
Plates and sheets[2] do	348	370	U.S.S.R. 262; Czechoslovakia 33; Poland 13.
Hoop and strip[2] do	12	14	West Germany 5; Czechoslovakia 3.
Rails and accessories do	[2]4	[2]3	Italy 1.
Wire and rods[2] do	46	48	Czechoslovakia 17; Austria 10.
Tubes, pipes, fittings[2] do	84	88	West Germany 23; Italy 20.
Castings and forgings[2] do	9	13	Yugoslavia 7; West Germany 3.
Other[2] do	6	8	France 2.
Total do	769	760	
Lead:			
Oxide	3,321	3,705	Austria 2,010; France 1,282.
Metal including alloys:			
Unwrought	[2]16,582	[2]14,880	Peru 1,750[4]; West Germany 1,365.
Semimanufactures	18	125	Belgium-Luxembourg 91.
Magnesium metal including alloys, all forms	13	22	West Germany 20.
Manganese ore and concentrate[2]	15,054	14,787	All from U.S.S.R.
Mercury 76-pound flasks	2,284	609	Spain 406; Italy 203.
Molybdenum:			
Ore and concentrate	10	138	Netherlands 71; Belgium-Luxembourg 67.
Metal including alloys, all forms	48	18	Japan 17.
Nickel metal including alloys:			
Unwrought	--	25	All from United Kingdom.
Semimanufactures	81	103	Austria 36; West Germany 22.
Platinum-group and silver metals, unworked or partly worked:			
Platinum-group value, thousands	$2,706	$2,089	West Germany $1,850.
Silver do	$3,050	$7,723	Switzerland $6,059; West Germany $1,576.
Tantalum metal including alloys, all forms kilograms	--	176	All from West Germany.
Tin:			
Oxides	6	--	
Metal including alloys:			
Unwrought	[2]1,503	[2]1,719	Belgium-Luxembourg 120; West Germany 66.
Semimanufactures	17	20	Denmark 13; Netherlands 4.
Titanium:			
Ore and concentrate	100	--	
Oxide	3,883	4,581	United Kingdom 1,474; West Germany 1,442; Italy 1,221.
Metal including alloys, all forms	2	--	
Tungsten:			
Ore and concentrate	--	1	All from Austria.
Metal including alloys, all forms kilograms	4,284	749	West Germany 700.
Zinc:			
Oxide and peroxide	1,131	2,003	Belgium-Luxembourg 1,040; Italy 572.
Metal including alloys:			
Blue powder	792	707	All from West Germany.
Unwrought	[2]21,709	[2]22,820	Poland 8,792; Finland 3,199; Yugoslavia 3,176.
Semimanufactures	[2]6,767	[2]2,779	United Kingdom 150; Yugoslavia 100.
Zirconium ore and concentrate	500	1,739	All from Italy.
Other:			
Ores and concentrates[2]	19,118	23,357	U.S.S.R. 17,894; Cuba 4,882.
Ash and residue containing nonferrous metals	--	330	Yugoslavia 302.
Oxides, hydroxides, peroxides	367	453	Japan 248; West Germany 95.
Metals:			
Metalloids	927	9,324	France 8,038.
Base metals including alloys, all forms, n.e.s.	204	103	Austria 42; Japan 32.
NONMETALS			
Abrasives:			
Grinding particles[2]	4,634	4,688	West Germany 2,735; Italy 1,161.
Dust and powder of precious and semiprecious stones value, thousands	--	$143	Belgium-Luxembourg $131.
Grinding and polishing wheels and stones	763	960	Austria 444; West Germany 221.

See footnotes at end of table.

Table 3.—Hungary: Apparents imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Asbestos[2]	41,632	39,100	U.S.S.R. 33,174; Austria 4,474.
Barite and witherite	17,722	18,525	Yugoslavia 16,445.
Boron:			
Crude natural borates	1,800	1,020	All from Netherlands.
Oxide and acid	1,913	3,907	U.S.S.R. 1,942; France 1,385.
Cement[2] thousand tons	799	815	U.S.S.R. 488; East Germany 256.
Chalk	2,518	2,936	Austria 1,654; France 1,266.
Clays and clay products:			
Crude:[2]			
Fuller's earth, chamotte, and products thereof	72,303	86,062	Czechoslovakia 80,948.
Kaolin	24,871	34,563	Czechoslovakia 11,756; East Germany 10,961.
Other	78,360	77,376	Czechoslovakia 47,940; Poland 17,564.
Products:			
Refractory[2]	51,117	51,584	Austria 28,745; West Germany 9,381.
Nonrefractory	2,523	3,530	Italy 1,321; Sweden 1,272.
Diamond:			
Gem, not set or strung value, thousands	$242	$631	Belgium-Luxembourg $449; Netherlands $101.
Industrial do	$849	$3,276	Belgium-Luxembourg $3,224.
Diatomite and other infusorial earth	913	979	Iceland 487; France 474.
Feldspar and fluorspar	7,990	7,834	Yugoslavia 4,753; Norway 2,160.
Fertilizer materials:[2]			
Crude:			
Phosphatic thousand tons	646	759	U.S.S.R. 553; Morocco 118.
Potassic do	3	3	U.S.S.R. 2; East Germany 1.
Manufactured:			
Nitrogenous, N_2 content do	130	113	U.S.S.R. 77; Czechoslovakia 30.
Phosphatic, P_2O_5 content do	147	175	United States 111; Yugoslavia 27; U.S.S.R. 26.
Potassic, K_2O equivalent do	499	610	East Germany 347; U.S.S.R. 258.
Other, including mixed do	114	135	U.S.S.R. 78; West Germany 34.
Graphite, natural	115	224	West Germany 199.
Gypsum, calcined[2]	67,465	74,382	East Germany 39,665; Romania 28,134.
Iodine[3]	55	80	Japan 44; U.S.S.R. 35.
Lime, calcined[3]	82,110	94,754	Czechoslovakia 24,989; Bulgaria 20,978; Poland 15,570.
Magnesite, calcined[3]	119,718	108,011	Czechoslovakia 77,011; North Korea 11,046.
Mica, crude and worked	88	155	United Kingdom 56; United States 46.
Pigments, mineral: Processed iron oxides	2,414	3,099	West Germany 2,583; France 509.
Precious and semiprecious stones, natural or synthetic value, thousands	$298	$286	Switzerland $246; Austria $22.
Pyrite[3]	59,318	81,451	All from U.S.S.R.
Salt[3] thousand tons	513	660	Romania 390; U.S.S.R. 169; Poland 73.
Sodium and potassium compounds, n.e.s.:[2]			
Caustic soda	122,320	94,918	Romania 44,393; West Germany 21,962.
Caustic potash	1,189	1,629	East Germany 1,184.
Soda ash	153,473	146,739	Bulgaria 99,125; Romania 21,928.
Stone, sand and gravel:			
Dimension stone	8,346	6,732	Italy 3,772; Yugoslavia 1,926.
Dolomite	--	15	All from West Germany.
Gravel and crushed rock[2]	210,974	240,414	Romania 120,946; Czechoslovakia 60,245; U.S.S.R. 44,520.
Limestone	98	--	
Quartz and quartzite	2,354	1,866	West Germany 1,595; Netherlands 228.
Sand, industrial[2]	121,944	121,913	Czechoslovakia 91,304; East Germany 14,535.
Sulfur:			
Elemental:			
Colloidal	52	73	Italy 45; West Germany 28.
Other than colloidal[3]	171,477	162,043	Poland 135,579.
Sulfuric acid[3]	8,543	28,757	U.S.S.R. 16,643; Poland 12,114.
Talc	3,087	2,977	Austria 1,552; Italy 1,168.
Other:			
Crude[2]	60,035	52,564	Czechoslovakia 11,853; Bulgaria 8,177; France 5,553.
Slag, dross, similar waste	--	6	All from West Germany.
Oxides and hydroxides of magnesium, strontium, barium	269	330	Greece 229; West Germany 61.
Halogens	364	34	All from Japan.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	48	22	All from West Germany.
Carbon black[2]	16,609	20,368	U.S.S.R. 18,248.
Coal and briquets:[2]			
Anthracite and bituminous coal thousand tons	1,524	1,420	Czechoslovakia 564; Poland 473; U.S.S.R. 384.
Briquets do	573	500	All from East Germany.
Coke and semicoke[2]	1,325	1,227	U.S.S.R. 652; Czechoslovakia 289; Poland 272.

See footnotes at end of table.

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Table 3.—Hungary: Apparents imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Gas, natural[2] million cubic feet	42,466	43,613	U.S.S.R. 36,162; Romania 7,063.
Petroleum:			
Crude[2] thousand 42-gallon barrels	62,830	73,346	U.S.S.R. 62,453; Iraq 9,972.
Refinery products:			
Gasoline[2] do	3,900	4,080	U.S.S.R. 4,046.
Kerosine[2] do	1,636	1,806	U.S.S.R. 1,535; Czechoslovakia 88.
Distillate fuel oil[2] do	4,568	6,304	U.S.S.R. 6,080.
Residual fuel oil[2] do	1,330	2,431	U.S.S.R. 1,625; Romania 460.
Lubricants, including grease[2] do	169	188	Romania 85; U.S.S.R. 33; Netherlands 30.
Other:			
Liquefied petroleum gas[2] do	274	232	All from U.S.S.R.
Nonlubricating oils do	10	--	
Mineral jelly and wax do	([5])	2	United Kingdom 1.
Petroleum coke do	5	7	Italy 6.
Bitumen and other mixtures do	--	([5])	Mainly from West Germany.
Bituminous mixtures do	1	7	France 5.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals[2]	46,040	39,407	U.S.S.R. 15,609; Italy 7,990; France 3,914.

NA Not available.

[1] Owing to the lack of official trade data published by Hungary, this table should not be taken as a complete presentation of Hungary's imports. Unless otherwise specified, data are compiled from trade statistics of individual trading partners, as well as the United Nations World Trade Annual, Walker and Co., New York.

[2] Official trade statistics of Hungary.

[3] United Nations. Quarterly Bulletin of Steel Statistics for Europe, New York.

[4] Metallstatistik (Metallgesellschaft) 1968-1978. Druckerei C. Adelman, Frankfurt am Main, West Germany 1979.

[5] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—About 20% of the 1979 bauxite production was exported to the centrally planned economy countries on the basis of long-term agreements. In 1978-79, alumina was produced at the three alumina works (Almasfuzito, Ajka, Mosonmagyarovar). More than one-third of the alumina produced was exported to the U.S.S.R. in accordance with the Hungarian-Soviet aluminum agreement. About 150,000 tons were exported to Western countries and the remaining alumina was processed by the Hungarian aluminum smelters and used by domestic ceramic and other plants.

The Hungarian Aluminum Corporation, Magyar Aluminiumipari Troszt, (MAT) directs all phases of Hungarian bauxite mining, alumina production, primary smelting, and semifabrication. Hungary, in 1978 and 1979, continued to rank second in Europe in the annual production of bauxite since its discovery of bauxite in 1920 and the start of mining in 1926. Recent changes in the world economy have considerably increased the value of Hungarian bauxite reserves and improved the country's comparative position in Europe. Low-grade bauxites previously considered unsuitable for the production of alumina have now become technically and commercially viable. Alumina production has been one of MAT's most actively developing sectors for many years. Most of the alumina produced in Hungary is exported under the long-term agreements of the COMECON-member countries, especially to the U.S.S.R. Recent renovations of the Almasfuzito alumina plant have increased its annual capacity by 40,000 tons and that of the Ajka plant by 80,000 tons.

Compared with its bauxite and alumina production, Hungary's smelting capacity is relatively small, since most of Hungary's domestic aluminum requirements are met through imports from COMECON under long-term agreements. The majority, 65%, is received from the U.S.S.R.

The domestic consumption of aluminum products has increased to 155,000 metric tons in 1978, compared with 143,000 tons in 1977. In 1978, 50% of total aluminum production was used domestically and 50% was exported[14]

In 1978, investments in alumina production decreased but almost doubled in primary smelting. The breakdown of the 1978 expenditures are as follows: Bauxite mining 4.7% (4.1% in 1977), alumina production 38.1% (50% in 1977), primary smelting 16%

(8.6% in 1977), production of semimanufactures 25.6% (22% in 1977), finished products 12.6% (9.4% in 1977), and corundum 3% (5.1% in 1977).[19]

Hungary maintains trade and technical exchange relations with various countries. For example, with Hungarian participation, alumina plants have been set up in India, Romania, and Yugoslavia. Hungary provided technical aid to design and build an integrated aluminum works in Turkey; performed feasibility studies for an integrated aluminum industry in Ghana; and prospected for bauxite and planned mines in several African, Asian, and European countries. The United States is also considered a large and increasing market and the high standards of the U.S. aluminum industry offer the possibility of exchange of the more efficient technologies and joint ventures. A special group, Aluterv, was formed by MAT over 20 years ago to handle such foreign operations.

Hungary plans to significantly expand its aluminum industry over the next few years, according to Lajos Dozsa, Director of MAT. There are plans for a new 100,000-ton-per-year smelter.

In 1978, two new bauxite mines were put into operation, the Bito-2 Mine at Kincsebanya (Fejer County) and Deak Mine at Nyirad (Bakony Hills). When fully operational, the Bito-2 will mine 500,000 tons and Deak, 450,000 to 660,000 tons, of bauxite annually. The Halimba-2 mine in the Bakony Hills is the largest bauxite mine in Europe and in 1978 its capacity stood at 600,000 tons of ore annually. The Halimba-3 continued to be under development in 1979, and is expected to start production in 1981 at 1.2 million tons of ore annually. The bauxite is to be transported from this underground mine via an inclined shaft by belt conveyors.

Preliminary work has begun in the Nagyegyhaza-Many area to produce both brown coal and bauxite. The Nagyegyhaza region contains brown coal reserves of about 55 million tons, which overlie an estimated 10 million tons of bauxite. The bauxite seam varies from 10 to 20 meters in thickness. Bauxite production should get underway in 1985 at a rate of 500,000 to 750,000 tons annually. The U.S.S.R. is to provide equipment for this development.

The Hungarian bauxite long-term development program envisages 75% of deposits to be in production or developed for exploitation by 1990, on the annual output of 3 to 3.5 million tons of ore. Currently most of the bauxite produced comes from the Bakony mines (Bakony Bauxite Mining Company). Most of the new output, however, will come from Kincesbanya mines in the Fejer Count (Fejer County Bauxite Mining Company), which eventually will become the leading ore producer. The group now includes two producing underground mines and a third underground mine under development; there is also a small open pit.

The expansion of the annual capacity of the Ajka alumina plant by 80,000 tons was one of the more important Hungarian projects in 1978 and, in 1978; the expansion was also completed of the Almasfuzito alumina works by 40,000 tons annually, thus reaching an annual capacity of 325,000 tons.[20] According to the Hungarian development plan, the output of alumina is to increase gradually to 1 million tons.

While Hungary was at the top of the European list in bauxite mining, the country's aluminum output amounted to only approximately 1.2% of total European production. Thus, there existed a great discrepancy between raw material production and the more profitable processing of ore. The main reason for this is that Hungarian aluminum metallurgy is not sufficiently up to date; the average age of smelters is 30 to 40 years. Bauxite in 1978 and 1979 was plentiful and alumina plants could easily keep up with demand if the smelters had been sufficiently modernized. Another reason why Hungarian aluminum industry wishes to expand its smelter capacity is the existing unprofitable Hungarian-Soviet aluminum exchange agreement.

In 1978 and 1979, the production of semimanufactures was being expanded at the Szekesfehervar light Metal Works. Among other items, the annual output of rolled stock was to be raised by 43,000 tons and the output of pressed and extruded items is to increase by 21,000 tons. The two hot- and two cold-rolling mills at the Szekesfehervar works were built by the U.S.S.R. The renovation is to cost an estimated Ft6 billion. In addition, Ft240 million was invested into the Kobanya light Metal Works, resulting in a 6,200 ton annual increase of aluminum foil production to be operational soon.

In 1978, a joint venture agreement was signed in Budapest with the U.S. firm Pressure Castings Corporation. A castings plant is to be built at Ajka by the United States and the products are to be marketed jointly in the Western countries. The designed annual capacity of the foundry is 3,000 tons and it is to become operational in 1980.[21]

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Copper.—The production of copper concentrate dropped by over 53% in 1978 compared with the previous year, and domestic mining in 1979 almost came to a standstill. Work continued at the newly developed Recsk copper mine, however. Hungary plans to eventually build a concentrator at the mine that would be able to process 5 million tons of ore annually. The Hungarians are seeking outside investments in the Recsk mine and are optimistic about their copper industry's prospects over the next 10 years. The Recsk deposit is thought to be among the world's largest, with the average copper content of 1.3%.

In 1978, a new copper wire plant was reportedly put into operation at the Gsepel metallurgical enterprise. The plant is to produce 30,000 to 40,000 tons of wire annually by 1980, when it will reach planned capacity. Some 20,000 tons of the wire is to be exported to market economy countries.

Gold.—The country's only gold mine is still in operation at Recsk but its output has been decreasing steadily. The turnover in gold jewelry in 1979 rose by some estimates by 15%, to Ft3 billion, compared with an average 5% growth in 1978. The price of 14-carat gold jewelry was raised by 10% in January and by 30% in November 1979. More than 8 kilograms of gold is to be recovered in 1980 from scrap at the United Incandescent Lamp Enterprise (Tungstram). Most of the scrap derives from semiconductors and radio parts which require gold alloy.

Iron Ore.—Hungary's production of iron ore, mostly sideritic, meets only 10% to 12% of domestic requirements; the U.S.S.R. was the major supplier of the iron ore. Mining at Rudabanya has now been leveling off for a number of years. In 1979, a long-term trade protocol was signed with India for the import of iron ore and ferroalloys in exchange for the Hungarian chemical fertilizers.

Iron and Steel.—Hungary, in 1978, reportedly invested Ft7 billion on the modernization of its metallurgical industry. Even though some of the iron and steel plants were modernized, the production fell short of the targets. The production shortfalls of pig iron were partly due to the blast furnace repairs at Lenin Metallurgical Works (at Diosgyor). At Ozd Works, where similar repairs have been completed, output was up but remained less than planned. The overhaul of the Ozd steelmaking plant also affected the output of steel. The output of rolled products by the Lenin Works proceeded as planned but the Danube Works (at Dunaujvaros) suffered a set-back due to supply difficulties.[32] Hungary in 1980 aims to produce 4 million tons of rolled steel products. The new Hungarian 5-year plan begins in 1981 and in this period a production target of 5 million tons of raw steel annually has been set. Owing to the projected moderate increase in consumption, export of rolled stock to the market economy countries is expected to grow. No major new investment projects will be started in 1980 but those in progress, such as the Danube and Lenin Works are to be continued.

Among the expansion underway in 1978-79 was the installation of an electric furnace at the Lenin Works, and plans were drafted for the replacement of the existing open hearths with oxygen converters. The Lenin Works also has long-term plans for a 1,000-cubic-meter blast furnace to replace the existing two 450-ton-per-day ones. According to R. Herendi, Deputy Manager of the Lenin Works, the new converter will be operational in 1980, producing a record of 1,030,000 tons of steel annually.

Work progressed at the Daube Works and the first converter is expected to be installed in 1981 and the second in 1982. Steel output is expected to reach 1.8 million tons at that time. The renovation is being carried out by 1,800 workers from Ganz-Mavag, with the aid of Polish specialists. At least 8,000 tons of stainless steel was produced at Danube in 1979 and, by 1980, five different types of special steels will be produced for the first time for domestic consumption.

Lead and Zinc.—No significant changes occurred during the 1978-79 period in the Hungarian lead and zinc industry. The only sizable lead-zinc mine at Gyongyosoroszi in Matra mountains produced 2,000 tons of lead concentrate and 5,000 tons of zinc concentrate in 1978, registering a decline from the previous year.

Manganese.—Most of Hungary's manganese ore is of the carbonate type and is aimed in the Western part of the country at Urkut. Smaller deposits also occur at Eger-Demjen area, approximately 110 kilometers northeast of Budapest. Some of the ore and concentrate are imported from the U.S.S.R. and various smaller amounts are exported to Poland and Czechoslovakia. Reportedly, in 1978, new reserves have been located in the Urkut area, mostly low grade (16% to 18% Mn) carbonate type.[33]

NONMETALS

Hungary satisfies its demand for most nonmetallic mineral requirements and even exports considerable quantities of perlite, glass sand, and bentonite. The output of bentonite and glass sand continued to increase in 1978-79. Most of the perlite was exported to the Federal Republic of Germany, Austria, Switzerland, Yugoslavia, and Czechoslovakia.

Cement.—Hungary in 1978-79 became more self-sufficient in its cement requirements. Because of the start-up of new facilities, production went up. The newest cement plant to start operation in 1979 was at Belapatfalva, at a planned production capacity of over 1.25 million tons annually. Another plant, at Hejocsaba, has been renovated at a projected capacity of 1.6 million tons annually. The equipment and machinery for the new plant were purchased from a West German firm, Palysius[34] The quarterly production of cement in Hungary varies; about 45% of it is produced in the first and fourth quarters, and about 55% in the second and third quarters.[35]

Clays.—Hungary has a well established bentonite production industry, with sufficient reserves to insure its availability for many years. The output of raw and processed bentonite in 1978-79 continued its steady increase, with new mining areas being opened at Ond and Istenmezeje. About 15% of the crude clay is exported annually, usually to the German Democratic Republic and Poland.

No significant changes occurred in the production of kaolin in the 1978-79 period. To supplement domestic consumption, processed kaolin continued to be imported from the eastern European countries, with smaller quantities of raw kaolin being exported to the same countries.

A new diatomaceous earth calcination plant has been put into production in 1979 at Erdobenye by the Hungarian Ore and Mineral Mines. New reserves were also located in that area.[36]

Fertilizer Materials.—Hungary has a stable fertilizer-manufacturing industry and especially a well established ammonia production sector. The anhydrous ammonia is even exported to various eastern European countries. All of the crude phosphate and potassium, however, are imported, primarily from the U.S.S.R. In 1978-79, almost 85% of the nitrogenous fertilizer was manufactured domestically, as was 55% of the phosphatic. Much of the supplementary nitrogenous and phosphatic fertilizers were imported from the U.S.S.R. In 1979, about 1.5 million tons of chemical fertilizers were used domestically and 1.7 million tons are to be used in 1980.

The Hungarian chemical industry, in general, envisions a 6.9% growth in 1980, even though the investments will be 12% less than in 1979. Of the manufactured fertilizers, 260,000 tons of phosphate (in nutrient content) are to be produced. The U.S.S.R., the largest exporter of fertilizer materials to Hungary, is to supply about 60% of its domestic requirements, including raw phosphate and manufactured potassic, nitrogenous, phosphorus, and ammonia phosphate fertilizers.

Reportedly, work started in 1978 on a new phosphate plant for Tisza Chemical Works at Szoluok in central Hungary. Assembly work is expected to take just over a year and test runs were scheduled for 1979. Depending on the success of the tests, the French firm Prorea will supply the machinery at a cost of FT782.2 million.[37] The refurbishment program of the Pet Nitrogen Fertilizer Plant was reportedly completed and production started in early 1979. The Kazincbarcika Ammonia Plant of the Borsod Chemical Complex was also reportedly nearing reconstruction completion in 1978.

Perlite.—Hungary in 1978-79 continued to be a leading producer and exporter of perlite. There were no significant changes in the perlite industry during this period and because of plentiful reserves a steady output is insured for many years to come.

MINERAL FUELS

Over 51% of the country's energy requirements in 1978-79 were imported. In spite of conservation programs, however, the forthcoming sixth 5-year plan is expected to provide for an increase in energy requirements equivalent to about 5 million tons of crude oil by 1985. About one-half of this additional demand is to be covered by nuclear energy from the new plant at Paks.[38] Because of depletion of domestic crude oil reserves, some official estimates project Hungary's imports of energy requirements by 1980 at 58%, in spite of the expected price increases. The U.S.S.R. accounts for over 40% of Hungarian energy imports. Because of the completion in 1979 of the Orenburg gas pipeline and of the Vinnitsa-Albertirsa electricity transmission line, the energy imports from the U.S.S.R. increased considerably. In addition, the Adria oil pipeline was nearing completion in 1979. The total energy balance for 1978 and 1979 is shown in table 4.

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Table 4.—Hungary: Primary energy balance for 1978 and 1979

(Million tons of standard coal equivalent[1])

Year	Total primary energy	Coal (lignite, anthracite, bituminous), coke, and briquets	Crude oil and petroleum products	Natural and associated gas	Fuelwood	Hydroelectric and other power
1978:						
Production	27.7	14.3	3.2	9.8	0.4	--
Imports	22.9	2.9	17.8	1.6	--	0.6
Exports	3.1	.02	3.1	.03	--	--
Apparent consumption	47.5	17.2	17.9	11.4	.4	.6
1979:						
Production	26.4	14.4	2.9	8.6	.5	--
Imports	26.0	2.8	17.5	5.0	--	.7
Exports	2.5	.02	2.5	.03	--	--
Apparent consumption	49.9	17.18	17.9	13.63	.5	.7

[1] 1 ton of standard coal equivalent (SCE)=7,000,000 kilocalories. Conversion factors used are: Hard coal, 1.0; lignite and brown coal, 0.5; briquets 0.67; coke, 0.9; crude oil, 1.47; refinery products, 1.53; natural gas, 1.33 (per thousand cubic meters); manufactured gas, 0.6; and hydroelectric power, 0.125 (per thousand kilowatt-hours).

Coal.—In spite of tremendous efforts, the output of coal in 1978-79 registered only marginal increases. Furthermore, the geological conditions and the access to coal seams have become such that more overburden has to be removed for the mining of a lesser quality of coal. New Pliocene lignite deposits have been discovered in northern Hungary, which are an extension of the lignite fields between Gyongyos and Fuzesabony. Deposits of high-quality coal are reported to have been discovered also in Hungary's northern Mecsek mountains. The coal's calorific value is estimated to be 150 calories higher than that of the neighboring Komlo mines. The existing Mecsek mines, in southern Hungary, is the only area in the country producing coking coal. New coal deposits were reportedly discovered also in the Borsod County, already a large producer of coal. The reserves are sufficient for more than 100 years and are to supply 5 million tons of coal anually.

In 1978, reportedly over Ft1 billion has been allocated for coal mine modernization.

By 1990, of the 54 mines now operating, only 31 will remain open under the Eocene Program. Some of the open pit operations will be replaced by four underground mines, with a planned total annual production of 8 million tons. The present 8 million tons of output from the Visonta open pit operation is also to increase gradually by 28%. In spite of this, however, the expanding rate of energy consumption is projected to be such that only 35% of Hungary's total energy demand will be covered by coal. In 1978-79, some 80% of coal production was used for the generation of electricity, using up approximately 17 million tons of coal, 7 million tons of which came from the Visonta open pit and the rest from underground mines.

The 12 mines at Borsod planned to produce over 5 million tons of coal in 1978, with the production in the future to remain at the same level due to closure of 3 smaller mines. The Juko mine of Borsod is to extract 1.25 million tons of lignite in 1980 and to transport it through pipeline. This is the first such installation in Hungary and will cost Ft200 million. Work began in 1979 on the development of a mine at Many, in northern Transdanubia, as part of the Eocene Program. The other two mines to be developed under this program are at Markudagy and Negyesyhaza. The mines are expected to become operative in 1981-82, with a joint capacity of over 9 million tons of lignite anually.

An explosion in 1978 at Tatabanya slowed the production somewhat to 2.4 million tons. The accident in the 12-A pit was caused by the explosion of methane gas. Twenty-six miners were killed by the explosion, the collapse of the shaft, and the accumulation of carbon monoxide. Following the accident, in 1979 the Mecsek coal-mining enterprise initiated a study for the prevention of gas explosions in mines. It will begin at the Zobak mine. A rock fall in 1979 in the 7-A shaft also at Tatabanya buried four miners, two of whom were rescued. In 1979, the No. 6 Mine at Tatabanya was closed due to depletion of reserves. During the 75 years of its operation, the mine produced 20 million tons of high-quality coal. Another accident in 1979, a cave-in at Komlb in the Beta mine of the Mecsek coalfield, caused the death of six miners.

A contract was signed in 1979 by representatives of the Hungarian Geological and Mining Engineering Co. (Geominco) with Coal Processing Consultants Ltd. (CPC), a division of Britain's National Coal Board. The contract is for the coal utilization study in which CPC will advise on the development of Hungarian brown coal and lignite deposits for potential applications in power generation and chemical production.[29]

There has been considerable cooperation between Austria and Hungary in energy supply since 1968. The two countries currently exchange 250,000,000 kilowatt-hours per year: In winter, when the mountain rivers supplying Austrian power stations are frozen, the Hungarians sell power to the Austrians; in summer, the Austrians provide for the Hungarians. There is also reciprocal support in the case of breakdowns. This close cooperation is now to be considerably expanded. Following an initial agreement in November 1979, plans have been announced for the sale of Hungarian lignite to Austria. In the neighborhood of Torony, a village west of Szombathely and close to the Austrian border, there is a lignite field of rather poor quality (averaging 1,800 kilocalories per ton) estimated at 600,000,000 tons. One-sixth of the field is on Austrian soil. According to the plan drawn up by Hungarian and Austrian energy specialists, the lignite will be strip-mined and transported to Austria on a 2- 2.5-kilometer belt conveyor in order to fuel a 600-megawatt Austrian power station which is being built. According to an earlier report, the lignite from Torony will be sufficient to guarantee fuel for the Austrian powerplant for the next 40 years. The project will be the largest yet undertaken between the two countries. According to Hungarian reports, about US 200 million is being spent on the development of the mine. Austrian Finance Minister Hannes Anrosch has reportedly offered the Hungarians $150 to $160 million in project-tied credits to develop the mine.[30]

Natural Gas.—Hungary, in 1978-79, consumed over 10 billion cubic meters of natural gas annually. Approximately 73% of the gas was produced domestically, the balance being imported from the U.S.S.R. and Romania. Over 27% of Hungary's energy requirements are met through the utilization of gas. In 1978-79, no new reserves of natural gas were discovered, but in the 1981-1985 period, 25% of production is to come from the fields discovered in 1977.

The Orenburg gas pipeline was completed in 1979, thus surging the gas supply from the U.S.S.R. to 134 billion cubic feet in 1980, which is 3 times the 1978 level. Natural gas imports are to amount to 40% of domestic consumption.[31] In order to accommodate the additional gas import, construction of a gas storage facility has begun at Hajduszoboszlo. Over Ft800 million will be spent on the construction of 35 storage tanks. Another project at Bekes County was in progress in 1978, for the conversion of a depleted gas reservoir at Kardoskut into a natural gas storage facility, with a planned capacity of over 5 billion cubic feet. The conversion is to cost Ft130 million and was to be completed in May of 1978.

Petroleum.—The production of crude oil continued to remain at the same level in 1978-79 and imports, mostly from the U.S.S.R., and some from Iraq, made up almost 93% of consumption in 1978. Hungary continued to export more refined products than it produced, supplementing the exports and domestic requirements with imports.

Most of Hungary's crude oil was recovered from the Szeged-Algyo oilfield, as in previous years. Seismic exploration has not uncovered any new reserves to date. The previously discovered oilfield in the Kiskunhalas district, however, became operational in 1978. According to estimates, this field will supply 20% of the country's total oil production on reaching full capacity.[32] For all practical reasons, geological exploration for gas and oil has ceased in Hungary, owing to poor geologic conditions. The proven oil reserves, at present level production, may last only for a few more years. However, some of the country's potential hydrocarbon resources remain to be discovered, Great Alfold (plain), also the source area of most of the present production.

In 1979 the Hungarian Oil and Gas Trust put into operation eight inclined wells located directly underneath the town of Szeged, the center of the Hungarian oil- and gas-bearing region. Once this program is fulfilled, 22 inclined wells are expected to pump crude oil from as deep as 2,700 meters; the 1979yield was originally set at 180,000 tons.[33]

Hungary's consumption of petroleum products was in the range of 52 million barrels in 1978. In order to expand its refining capacity, production began in 1979 at the new Tisza crude oil refinery at Leninvaros. The plant is capable of refining 3 million tons of crude oil annually and is to supply the Lefin plant with derivatives for the chemical industry and the Tisza thermal power station with heating oil. With the receipt of 8.5 million tons of crude oil through the Friendship pipeline from the U.S.S.R., the four Hungarian refineries plan to produce almost 11 million tons of

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processed products in 1980. Of this total, 7.4 million will be refined in Szazhalombatta, 1.8 million in Lenin City (Tisza refinery), 1.2 million in Szony, and 200,000 tons in the Zala refinery.

Work continued in 1979 on construction of the Adriatic oil pipeline, scheduled for completion in 1980. A joint project with Czechoslovakia and Yugoslavia, Hungary is slated to receive some 5 million tons of crude oil via the pipeline from the Middle East and North Africa.

Uranium.—It appears that development of the No. 5 uranium mine in the Mecsek mountains neared completion at the end of 1978. The uranium in Hungary occurs in Permian sandstones, at depths of up to 1,000 meters. The source beds are about 500 meters thick and also contain vanadium. The U, Cr, and V content of the sandstone varies greatly, ranging from 0.008% to 0.15% U_3O_8, 0.16% to 3% Cr_2O_3 and 0.03% to 0.8% V. According to some reports, more than several hundred tons of U_3O_8 is mined from one Pecs mine in the Mecsek mountains. Reasonably assured Hungarian reserves of uranium are calculated at 5,000 to 10,000 tons and estimated reserves at 15,000 to 30,000 tons.

The only Hungarian nuclear powerplant at Paks was nearing completion in 1979 and the first of four units is scheduled for operation in 1980. Reportedly, Ft7 billion was spend in 1979 on the Paks project, a record for any single project in 1 year.

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[1] Physical scientist, Branch of Foreign Data.

[2] Statisztikai evkonyv (Statistical Yearbook), 1978, Budapest. 1979. Hungarian Review, Budapest. April 1978.

[3] The value of Hungarian forints (Ft) varies widely between the official exchange rate and the value used for some transactions. At the end of 1979, the exchange rate was Ft35.58 = US$1.00 (Ft100 = US$2.81).

[4] COMECON (also referred to as CEMA or CMEA) - The Council for Mutual Economic Assistance; an organization of 10 Communist countries involved in economic cooperation and coordination, comprising in 1979 the following countries: Bulgaria, Cuba, Czechoslovakia, the German Democratic Republic, Hungary, Mongolia, Poland, Romania, the U.S.S.R., and Vietnam. Yugoslavia obtained a permanent observer status in 1965.

[5] Kulkereskedelmi Statisztikai Evkonyv (Foreign Trade Statistical Yearbook), 1978, Budapest. 1979.

[6] Hungarian Review, Budapest. April 1979.

[7] Magyar Kozlomy (Hungarian Official Bulletin), Budapest. No. 91, Dec. 30, 1978, pp. 1011-1014.

[8] Nepszabadsag (People's Freedom), Budapest. Feb. 4, 1979, pp. 1, 3.

[9] Figyelo (Observer), Budapest. Oct 11, 1978, p. 5; Jan. 1, 1980, pp. 1, 2.

[10] Nepszabadsag (People's Freedom), Budapest. Jan. 17, 1979, p. 10.
Hungarian Foreign Trade, Budapest. No. 1, 1979, pp. 9-16.

[11] Nepszava (People's Voice), Budapest. Jan. 21, 1979, pp. 1, 5. Figyelo (Observer), Budapest. No. 14, Apr. 4, 1979, p. 1.

[12] Nepszabadsag (People's Freedom), Budapest. Jan. 30, 1980, p. 1.

[13] Vilaggazdasag (World Economy), Budapest. Mar. 1, 1980, pp. 4-5.

[14] Work cited in footnote 13.

[15] Magyar Hirlap (Hungarian News Bulletin), Budapest. May 11, 1979, p. 7.
Figyelo (Observer), Budapest. No. 7, Feb. 14, 1979, p. 5.

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[17] Vilaggazdasag (World Economy), Budapest. Apr. 28, 1979, p. 3.
Kulgazdasag (Foreign Trade), Budapest. No. 9, September 1978, pp. 24-33.
Work cited in footnote 13.

[18] Magyar Aluminium (Hungarian Aluminum), Budapest. No. 16, September 1979, pp. 269-279.
Aluminium, Budapest. January 1980, pp. 57-58.

[19] Metal Bulletin, London. June 1979, pp. 37-41.

[20] Hungarian Review, Budapest. October 1978, p. 15.

[21] Aluminium, Budapest. No. 54, April 1978.

[22] Metal Bulletin, London. Oct. 2, 1979, p. 37.

[23] World Mining, San Francisco. July 25, 1979, pp. 215-216.

[24] Hungarian Review, Budapest. No. 11, 1978, p. 15.

[25] Figyelo (Observer), Budapest. No. 3, Jan. 16, 1980, pp. 1, 6.

[26] Banyaszat (Mining), Budapest. V. 113, No. 1, 1980, pp. 29-34.

[27] Industrial Minerals, London. March 1978.

[28] Petroleum Economist, London. July 1978, p. 301. Vilaggazdasag (World Economy), Budapest. Apr. 28, 1977, p. 3.

[29] Mining Journal, London. May 25, 1979, p. 414.

[30] Magyarorszag (Hungary), Budapest. No. 45, Nov. 11, 1979, p. 37.

[31] Muszaki Elet (Technical Life) Budapest. No. 11, June 1, 1979, pp. 1, 18.

[32] Mining Annual Review, London. June 1979, pp. 591-593.

[33] International Petroleum Times, London. Mar. 1, 1979.

The Mineral Industry of Iceland

By Joseph B. Huvos[1]

In 1978-79, the Icelandic economy grew at a rate of 3.7%, despite a high inflation rate. The country's foreign trade balance, adversely affected by increasing oil prices, may be balanced soon by new exports of ferrosilicon. In February, 1978 the Central Bank of Iceland devalued the Krona by 13%, and steps were taken to exchange 100 Kronas to one new Krona.

Unemployment was 0.6%. The gross national product (GNP) was about $2.1 billion.[2] The mineral industry's chief contributions to the national economy continued to be inexpensive hydroelectric power, geothermal energy, aluminum, and some nonmetallic minerals.

Notable events in Iceland's mineral industry included announcement of plans to increase the capacity of the Alusuisse aluminum plant, commissioning of Icelandic Alloy's ferroalloy plant, continued development of geothermal and hydropower, and exploration for oil on Iceland's continental shelf.

PRODUCTION

Primary aluminum and modest quantities of cement, diatomite, ammonia, and pumice were the only mineral products of Iceland, shown for 1977, 1978, and 1979 in table 1.

Table 1.—Iceland: Production of mineral commodities

Commodity and unit of measure	1976	1977	1978[p]	1979[e]
Aluminum metal, primary ---------------- metric tons	65,300	74,245	73,800	[1]72,145
Cement, hydraulic ------------ thousand metric tons	145	139	183	135
Diatomite[2] ---------------------------- metric tons	22,699	20,985	20,020	20,000
Iron and steel ferroalloys: Ferrosilicon ------------ do	--	--	--	15,000
Nitrogen, N content of ammonia[e] ----------------- do	8,000	6,000	7,000	7,000
Pumice[2] ------------------------------------ do	1,529	7,586	8,497	9,000
Sand and gravel:				
Calcareous ------------------ thousand cubic feet	105	111	107	[1]113
Other ------------------- thousand metric tons	513	430	421	NA
Stone:				
Crushed and broken ------------------------ do	28	30	28	[1]25
Scoria ----------------------------------- do	93	100	100	[1]110

[e]Estimate. [p]Preliminary. NA Not available.
[1]Reported figure.
[2]Exports.

TRADE

In 1978 and 1979, there was no significant change in Icelands modest foreign mineral trade. Total mineral trade in Iceland is shown in table 2.

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Table 2.—Iceland: Foreign trade in mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978
EXPORTS		
Aluminum metal including alloys, unwrought	74,245	77,349
Diatomite	20,985	20,020
Iron and steel scrap	2,224	8,842
Nonferrous metal scrap and metal-bearing residues	456	407
Pumice	7,586	8,497
IMPORTS		
METALS		
Aluminum:		
Alumina	113,168	141,907
Metal including alloys:		
Unwrought	90	77
Semimanufactures	1,055	826
Chromium oxide and hydroxide	3	3
Copper metal including alloys, unwrought and semimanufactures	227	156
Iron and steel metal:		
Pig iron, ferroalloys, similar materials	47	134
Steel, primary forms	803	417
Semimanufactures:		
Bars, rods, angles, shapes, sections	19,511	20,665
Universals, plates, sheets	11,624	14,446
Hoop and strip	319	229
Rails and accessories	37	17
Wire	289	262
Tubes, pipes, fittings	9,495	7,453
Total	41,275	43,193
Lead:		
Oxides	20	25
Metal including alloys:		
Unwrought	68	40
Semimanufactures	1	1
Mercury 76-pound flasks	6	5
Nickel metal including alloys, all forms	4	2
Platinum-group and silver metals including alloys:		
Platinum-group value, thousands	$78	$125
Silver do	$200	$318
Tin metal including alloys, unwrought and semimanufactures	11	3
Titanium oxides	696	522
Tungsten metal including alloys, all forms value	$1	$3
Zinc:		
Oxide	11	14
Metal including alloys:		
Blue powder	10	5
Unwrought	130	143
Semimanufactures	11	10
Other:		
Oxides, hydroxides, peroxides of metals	4	5
Base metals including alloys, all forms	1	1
NONMETALS		
Abrasives, natural, n.e.s	45	29
Asbestos	12	11
Barite and witherite	17	21
Boron materials	5	1
Cement, hydraulic	26,309	15,687
Chalk	222	299
Clays and clay products (including all refractory brick):		
Crude	517	296
Products:		
Refractory (including nonclay brick)	1,478	1,758
Nonrefractory	1,061	1,047
Cryolite and chiolite	500	500
Diamond, all grades value	(1)	$7
Diatomite and other infusorial earth	3	34
Fertilizer materials:		
Crude	14	10
Manufactured:		
Potassic	10,118	5,801
Other, including mixed	26,737	20,290
Ammonia	4,462	3,015
Gypsum and plasters	8,453	7,461
Lime	1,033	942
Mica, all forms	12	14
Pigments, mineral, including processed iron oxides	87	47
Precious and semiprecious stones, except diamond value	$14	$20
Salt and brines	48,912	56,397
Sodium and potassium compounds, n.e.s	534	546

See footnotes at end of table.

Table 2.—Iceland: Foreign trade in mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
NONMETALS —Continued		
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	69	54
Worked	64	86
Dolomite, chiefly refractory grade	54	76
Gravel and crushed rock	326	417
Limestone	585	60
Quartz and quartzite	47	73
Sand, excluding metal bearing	290	271
Sulfur, all forms[2]	723	732
Talc, steatite, pyrophyllite	89	105
Other:		
Crude	12	7
Oxides and hydroxides of magnesium, strontium, barium	20	18
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	622	457
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	--	1
Carbon black and gas carbon	1	--
Coal, coke, peat	317	276
Petroleum refinery products:		
Gasoline, aviation and motor — thousand 42-gallon barrels	700	834
Kerosine and jet fuel — do.	718	682
Distillate fuel oil — do.	2,401	2,252
Residual fuel oil — do.	824	764
Lubricants — do.	70	46
Other:		
Liquefied petroleum gas — do.	10	10
Mineral jelly and wax — do.	3	4
Pitch coke — do.	5	28
Bitumen and other residues — do.	60	NA
Unspecified — do.	3	2
Total — do.	4,794	4,622
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	244	266

NA Not available.

[1] Less than 1/2 unit.

[2] Mainly sulfuric acid.

COMMODITY REVIEW

METALS

Aluminum.—Plans were announced by Alusuisse to expand the capacity of the company's Straumsvik reduction plant, located south of Reykjavik, from 75,000 tons to 85,000 tons per year. Forty pots have to be added to the existing 280 pots. Work on the expansion started in March 1979 and is to be completed in 1980. In 1978, the reduction plant operated at 98.5% of its nominal capacity. Alusuisse controlled the plant through Icelandic Aluminum Co. Ltd., a wholly owned subsidiary.

Ferroalloys.—Production started in spring 1979 at Icelandic Alloy's 50,000-ton-per-year ferrosilicon plant on the north shore of Hvalfjordur near Grundartangi. Icelandic Alloys is jointly owned by the Icelandic state and Elkem Spigerverket of Norway, with the former holding the controlling interest. According to plans, only the first of two 40-megawatt furnaces began operating. Full production is expected to start in September 1980.

About 200,000 tons of raw material is to be imported each year for the plant, and ferrosilicon produced is to be exported, using Icelandic-owned vessels. In 1978, the Icelandic Government was considering a temporary slowdown of the project with the purpose of decreasing inflation.

MINERAL FUELS

In 1978-79, hydroelectric and geothermal power continued to supply the smaller half of the country's energy needs. The remainder was mainly petroleum products imported from the U.S.S.R. and various western sources.

Geothermal Power.—In November 1978, the shaft of steamwell No. 11 of the National Energy Authority's Krafla geothermal project (northeast Iceland) was lined for tapping superheated water from strata below 1,200 meters. If a total of four wells can become operational, the geothermal powerplant can be started at the level of 5

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megawatts. Delays in starting the powerplant were caused by earthquakes that damaged the plant's existing steam wells.

By 1978, about half of all houses in Akureyri, northern Iceland, were hooked up to municipal geothermal heating systems; in 1980, all remaining houses are to be connected to the system. Work continued in the Keflavik area, near Grindarvik, southwest Iceland, at the Sudurnes low-temperature geothermal powerplant and feeder lines, where the airport is also to be supplied with geothermal heat after 1980.

Installed geothermal capacity in Iceland increased by about 50% over the last 4 years to 520 megawatts. Tapped mostly thus far are numerous so-called low-temperature areas for water used in municipal heating systems. Geothermal steam provides the energy at Grindarvik. The only major attempt to harness a high-temperature geothermal site for generating electricity is the Krafla project in northern Iceland.

Hydroelectric Power.—The National Power Company of Iceland, in agreement with the Ministry of Industry and Energy, has decided to review the construction schedule of the Hrauneyjafoss hydroelectric powerplant, the third in the Thorsa River basin of the south-central region. The National Power Company of Iceland is jointly owned by the state and the city of Reykjavik, and supplies 70% of Iceland's population, the aluminum smelter at Straumsvik, and the ferrosilicon plant at Grundartangi.

In order to curb inflation, the Government wanted to trim investment, including that for hydroelectric power. Work at Hrauneyjafoss started in 1978, and the plant, which is scheduled to go online at half capacity in 1981, is to be completed 1 year later than planned. A 140-kilometer section of the National Power Grid was inaugurated during the year forming a link between the central-west, north, and south Icelandic power lines. When completed within 10 years, the national power grid system is to completely encircle Iceland.

Petroleum.—Geophysical search for offshore oil was started in November 1978 north and northwest of Iceland. This project was undertaken by the Western Geophysical Corporation, an England-based U.S. research organization, which, besides paying a fee to the Icelandic Government, will underwrite the entire cost. The Ministry of Industry of Iceland will participate as an observer in the search and its evaluation.

Iceland had no crude oil production or oil refinery and imported each year over 600,000 tons of petroleum products from the U.S.S.R. and Western Europe.

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[1] Physical scientist, Branch of Foreign Data.

[2] American Embassy, Reykjavik, Iceland. State Department Airgram A-34, Dec. 4, 1979, p. 4.

The Mineral Industry of India

By Gordon L. Kinney[1] and Francis E. Shafer[2]

The mineral industry of India was an important factor to the economy. It accounted for about 1.5% of India's gross national product (GNP) in 1978 and employed about 4% of the organized labor force. Downstream employment depending directly on domestic mineral output was several times that figure, and included the steel, aluminum, copper, and zinc producers and their associated heavy manufacturing, transportation, and rural electric power development sectors.

Continuing exploration efforts conducted or supported by the Government-owned Geological Survey of India (GSI), Mineral Exploration Corp. (MEC), National Mineral Development Corp. (NMDC), Oil and Natural Gas Commission (ONGC), and the various State mineral development corporations, added significantly to the mineral reserves picture of the country. India has large proved and indicated reserves of bauxite, iron ore, mica, manganese, chromite, barite, heavy mineral sands, and coal. Offshore exploration drilling during 1978-79 confirmed additional reserves of petroleum and natural gas.

In December 1978 there were approximately 2,100 active nonfuel mines in India that were large enough to be required to report to the Government. Nearly 500 were producers of 10 different metallic ores and the remainder produced a total of 36 different nonmetallic minerals.

Overall, the private sector employed over 120,000 persons in mining, while the public sector accounted for over 760,000.[3]

The Indian economy had a relatively good year in 1978. The GNP increased approximately 4.0% in 1978-79[4] to $66.4 billion.[5] Conditions took a turn for the worse, however, in 1979 and the GNP was expected to decline about 3% in 1979-80 to about $64.4 billion.[6] At current prices the GNP was $109 billion in 1977-78, $117 billion in 1978-79, and estimated at $131 billion in 1979-80.[7] The poor performance of the economy during 1979 was caused by several factors. The most important was the lower than normal rainfall in the southwest which brought drought conditions to much of the country and a large decrease in the amount of power normally generated by the hydroelectric plants. The food grain harvest in 1979 was estimated at 16 million tons less than in the previous record high year. Other factors affecting the economy were the loss of industrial production from severe electric power shortages, scarcity of industrial raw materials, transportation and port bottlenecks, and labor unrest.

The $1.7 billion budget deficit initially projected in February 1979 climbed during the year and almost doubled to $3.3 billion. Drought relief and welfare expenditures, cost-of-living allowances for government employees and increased cost of crude oil were the major contributors to the expanding deficit.

A sharp inflationary trend developed early in 1979 and continued through the summer. Prices were driven upward by the projected budget deficit; a sharp increase in the money supply; increased taxes; higher cement, steel, and petroleum prices; and anticipation of a poor harvest following the lower than normal rainfall. Wholesale prices were increasing at a 25% annual rate in March 1979, then settled down and finished with a net increase of about 16.4% for 1979-80.

In 1979-80, for the first time in recent years, India's industrial production growth rate was zero, compared with a 7.6% increase in 1978-79.

Production of electric power totaled 103 billion kilowatt-hours in 1978-79, a 12% increase over the 92 billion kilowatt-hours

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reported for 1977-78. The increase was a nominal 1% to 104.3 billion kilowatt-hours in 1979-80. The installed generating capacity was increased from 25,800 megawatts in 1977, to 28,800 megawatts in 1978, and an additional 3,200 megawatts were scheduled for completion in 1979-80.[8]

Despite the substantial and expensive capacity gains, the power industry has not kept up with the even more rapidly increasing demands from industry and agriculture. Most of India has been experiencing a chronic and often worsening shortage of electric power over the last few years which has been a major constraint on the utilization of India's mining, industrial, and agricultural capacity. The most seriously affected industries were aluminum, cement, fertilizer, iron and steel, and petrochemicals.

In 1979 the drought's effect on the hydroelectric power output was but one exacerbating factor in the power shortages. Water in most reservoirs was well below normal levels in 1979. Among the hardest hit areas was the industrial belt of Bihar and West Bengal where most of the country's coal mines, steel plants, and heavy industry are concentrated. Also experiencing economically disruptive power cutbacks were Maharashtra, Haryana, Punjab, and Uttar Pradesh. The loss of hydroelectrically generated power threw the load on the already overtaxed thermal powerplants.

The thermal power shortages stem from an excessively low capacity utilization factor, 51.5% in 1977-78, 48.6% in 1978-79, and 45.0% in 1979-80.[9] The current power deficit is estimated at about 16% for the country as a whole and is much higher in the eastern and northeastern regions. This situation was caused by a variety of interrelated factors including poor quality coal, equipment maintenance problems, and powerplant design and construction deficiencies; railroad transport bottlenecks; and failure to produce sufficient quantities of coal.

In the east some of the worst power shortages were occurring in the coal mines themselves. Cutoff or reduction of power to the water pumps and ventilation equipment caused dewatering problems and the danger of gas explosions, thereby frequently closing down the very source of fuel on which the powerplants were dependent. This no-win spiral was often compounded by shortages of railroad cars and inefficiency in moving and loading them.

The direct loss of industrial producton to power stoppages during 1979 was estimated by independent sources at over $9 billion, and the overall loss to the economy, particularly during 1979, certainly must have cost several percentage points on the GNP.

PRODUCTION

The total value of mineral production during 1978 was $1.67 billion compared with $1.57 billion in 1977. Mineral fuels constituted the leading group with $1,318 million or 79%, metallic minerals $225 million or 13%, and nonmetallic minerals $131 million or 8% of the total value. Coal and lignite contributed 54% of the value followed by petroleum and natural gas 25%; iron ore 7%; limestone 4%; copper 2%; and phosphate rock, manganese ore, gold, chromite, and zinc ore with 1% each.

Production of coal was nearly static despite a large planned increase and serious widespread shortages. Petroleum output continued to climb at an impressive rate. However, consumption increased even faster, forcing a large increase in the petroleum import bill.

The value of metallic mineral production declined slightly in 1978. All of the major metal ores except bauxite, lead, zinc, and the rare-earth metals recorded lower output value compared with 1977. The value of nonmetallic mineral production dropped moderately compared with 1977, although several of the important ones, including phosphate rock, barite, graphite, gypsum, and magnesite, did record higher outputs.

Geographically, five States accounted for about 70% of the total value of mineral production. These were Bihar with 27%; Madhya Pradesh, 14%; West Bengal, 11%; and Gujarat and Assam with about 9% each.

Nearly all of Gujarat's and Assam's values were from petroleum and natural gas, while Bihar produced mostly coal, iron ore, copper ore, and bauxite.

It was interesting to note that the mineral production value from the offshore Bombay High oil and gasfields doubled between 1977 and 1978 and had climbed to sixth ranking after Assam State. A large production increase planned for the offshore oilfields in 1979 will probably move the offshore output into third or even second ranking behind Bihar. According to the current expansion plans, production from the offshore area by 1983 will be at a level where its value will put it first in geographic ranking and economic importance.

Table 1.—India: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Bauxite, gross weight .... thousand tons	1,448	1,511	1,653	1,600
Alumina, gross weight .... do.	442	[e]390	480	450
Metal, primary	209,549	179,000	213,729	[2]211,759
Antimony metal, regulus	404	186	--	--
Cadmium metal	34	44	113	180
Chromium: Chromite, gross weight	402,118	352,500	265,900	272,000
Copper:				
Mine output, metal content	28,800	31,200	[e]23,000	28,500
Metal:				
Smelter	24,800	23,500	19,600	24,100
Refined	20,900	22,800	17,600	30,300
Gold metal, smelter .... troy ounces	100,696	96,902	87,579	[2]84,749
Iron and steel:				
Iron ore and concentrate, gross weight .... thousand tons	43,868	42,598	38,155	45,700
Metal:				
Pig iron .... do.	9,776	9,796	9,432	8,767
Ferroalloys:				
Ferrochrome	17,059	18,068	21,474	19,000
Ferromanganese	175,506	193,908	219,517	205,000
Ferrosilicon	53,970	44,675	52,899	45,400
Ferrosilicochrome	5,002	4,155	3,970	3,600
Other	303	10,833	3,540	900
Crude steel:				
Steel ingots .... thousand tons	9,194	9,852	9,917	9,400
Steel castings .... do.	61	66	[e]70	65
Total .... do.	9,255	9,918	[e]9,987	9,465
Semimanufactures:[3]				
Angles, shapes, sections .... do.	908	1,012	1,040	1,000
Bars and rods .... do.	2,534	2,312	2,300	2,200
Plates and sheets:				
Uncoated .... do.	970	1,019	1,062	1,100
Galvanized .... do.	178	192	194	200
Tinplate .... do.	114	110	90	100
Hoop, strip, strapping, skelp .... do.	1,092	1,166	1,153	1,100
Rails and accessories .... do.	376	497	452	500
Wire .... do.	321	326	351	300
Special steels, not further specified .... do.	322	352	422	400
Total .... do.	6,815	6,986	7,064	6,900
Lead:				
Mine output, metal content	12,120	12,720	[e]16,200	13,000
Metal, primary	5,435	7,588	9,177	10,000
Magnesium	30	107	23	45
Manganese ore and concentrate, gross weight .... thousand tons	1,835	1,865	1,568	1,630
Rare-earth metals: Monazite concentrate, gross weight[4]	3,000	[r] [e]2,734	3,272	2,800
Selenium .... kilograms	723	4,078	5,151	5,000
Silver, mine and smelter output .... thousand troy ounces	102	425	389	450
Titanium concentrates, gross weight:[4]				
Ilmenite	82,000	[r] [3]137,350	[3]149,000	143,000
Rutile	3,600	[r] [3]5,491	[3]5,000	9,000
Tungsten, mine output, metal content	23	28	21	23
Zinc:				
Mine output, metal content	27,408	32,500	39,768	39,000
Metal	26,785	35,997	59,354	65,000
Zirconium concentrate: Zircon, gross weight[4]	10,300	[r]10,677	10,322	10,000
NONMETALS				
Abrasives, natural, n.e.s.:				
Corundum, natural	[r]528	1,306	1,076	1,100
Garnet	2,075	1,825	2,467	6,806

See footnotes at end of table.

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Table 1.—India: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Abrasives, natural, n.e.s. —Continued				
Jasper	1,503	1,450	1,200	2,000
Asbestos	24,119	22,177	19,100	20,000
Barite	235,068	330,980	351,340	363,000
Cement, hydraulic thousand tons	18,640	19,060	19,560	[3]18,264
Chalk	69	61,414	72,840	70,000
Clays:				
Ball clay	35,209	48,309	35,562	36,000
Diaspore	10,090	7,900	4,909	5,000
Fire clay	666,000	726,000	692,000	690,000
Kaolin:				
Direct salable, crude thousand tons	335	349	323	330
Processed do	103	96	101	104
Total do	438	445	424	434
Other do	242	129	162	130
Diamond:				
Gem[e] thousand carats	17	15	14	16
Industrial[e] do	3	3	2	2
Total do	20	18	16	18
Feldspar	55,307	54,710	47,783	45,000
Fluorspar:				
Acid grade	9,709	9,069	9,611	10,900
Metallurgical grade	4,271	6,140	4,290	5,200
Total (graded)	[r]13,980	15,209	13,901	16,100
Concentrates (graded)	3,643	3,586	3,432	3,500
Gem stones, excluding diamond:				
Agate (including chalcedony pebble)	3,128	1,768	2,055	2,000
Emerald, crude carats	825	550	20,680	10,000
Garnet kilograms	3,673	5,520	4,912	4,400
Graphite	38,273	48,455	60,057	50,000
Gypsum thousand tons	727	778	834	900
Kyanite and related materials:				
Andalusite	NA	387	225	227
Kyanite	48,779	42,123	28,214	27,200
Sillimanite	14,859	15,028	13,295	13,000
Lime	182,000	[e]182,000	[e]200,000	400,000
Magnesite	329,698	402,007	419,641	426,000
Mica:				
Exports:				
Block	[r]890	1,009	1,455	1,400
Film and disk	146	126	123	130
Splittings	[r]3,534	3,445	4,186	4,200
Scrap	8,055	9,958	[e]9,900	12,000
Powder	[r]9,238	7,505	[e]8,200	8,400
Manufactured	301	470	[e]400	400
Total	[r]22,164	22,603	24,264	26,500
Domestic use (all forms)[e]	[r]11,100	[r]11,200	11,400	11,600
Grand total	[r]33,264	33,803	35,664	38,100
Nitrogen, N content of ammonia thousand tons	1,910	2,007	2,220	2,900
Phosphate rock	644,058	704,961	751,830	700,000
Pigments, mineral, natural: Ocher	92,053	75,935	73,230	75,000
Pyrite, gross weight	47,531	31,085	54,163	40,000
Salt, all types thousand tons	4,438	3,750	4,380	4,540
Sodium carbonate	564,000	567,600	590,000	610,000
Stone, sand and gravel:				
Calcite	21,567	27,445	28,388	29,000
Dolomite thousand tons	1,886	2,152	1,942	2,000
Limestone do	29,891	30,280	30,169	30,000
Quartz and quartzite do	414	380	356	360
Sand:				
Calcareous do	1,074	808	932	900
Other do	1,756	1,677	1,620	1,600
Slate	3,843	21,826	12,608	12,000
Sulfur content of pyrite	19,222	[e]14,080	[e]20,000	15,000
Talc and related materials:				
Pyrophyllite	34,080	34,619	32,249	32,000
Steatite (soapstone)	220,000	247,000	276,000	286,000
Vermiculite	3,435	2,878	1,896	1,814
Wollastonite	4,541	3,830	1,964	2,000

See footnotes at end of table.

Table 1.—India: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS				
Carbon black[e]	50,000	50,000	55,000	54,000
Coal:				
Bituminous thousand tons	100,876	100,297	101,544	[e]103,452
Lignite do	3,895	3,632	3,634	[e]3,264
Total do	104,771	103,929	105,178	[e]106,716
Coke:				
Coke oven and beehive do	[e]9,620	10,000	[e]12,100	12,000
Gashouse do	48	[e]50	[e]47	100
Other, soft[e] do	3,700	3,700	50	50
Total do	13,368	13,750	12,197	12,150
Gas, natural:				
Gross million cubic feet	85,108	96,282	97,823	100,000
Marketable[4] do	53,466	54,561	61,129	64,000
Petroleum:				
Crude thousand 42-gallon barrels	64,632	75,787	92,812	99,000
Refinery products:				
Gasoline do	11,169	11,645	12,891	14,000
Kerosine do	27,980	19,282	19,515	22,000
Jet fuel do		8,160	9,424	10,000
Distillate fuel oil do	54,518	60,993	64,490	67,000
Residual fuel oil do	32,947	34,938	38,601	42,000
Lubricants do	2,380	2,828	3,403	3,700
Other do	27,991	32,459	34,643	42,300
Refinery fuel and losses do	11,067	10,778	13,377	14,000
Total do	168,052	181,083	196,353	215,000

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities listed, bromine, other clays (bentonite, fuller's earth, and common clays), other gem stones (aquamarine, ruby, and spinel), and uranium are also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels. In 1975, production of 6,514 tons of uranium ore containing about 3 tons of U_3O_8 was reported from two mines, which was only a part of total national production.

[2] Reported figure.

[3] Data are for fiscal years beginning Apr. 1 of that stated.

[4] Includes reinjected gas.

TRADE

According to provisional trade data, exports during fiscal year (FY) 1979-80 totaled $7.3 billion while imports were valued at $10.0 billion, resulting in a deficit of $2.7 billion compared with a deficit of $1.3 billion in FY1978-79 and $0.8 billion in FY 1977-78. This sharp rise in the trade deficit led to a lowering in the current account position which was reflected in a decline of $68 million in foreign exchange reserves in FY1979-80 compared with an increase of $1,130 million in FY1978-79.

India's exports rose by only 5.9% in FY1978-79 and about 7.4% in FY1979-80. This was a sluggish performance compared with the 27% average annual increase in the 4 previous years.

Of the $6.98 billion total exports in FY1978-79, the major mineral or mineral-related commodities included gem stones and jewelry, $867 million; iron ore, $284 million; steel, $140 million; silver, $115 million; mica, $23 million; and manganese ore, $19 million.[18] The major export market for the gems and jewelry were Belgium, Hong Kong, Japan, the United Kingdom, and the United States. Iron ore, the second ranking export mineral, went principally to Japan (about 64%), Romania, South Korea, and Iraq.

Mineral imports were dominated by petroleum in 1978-79 and the proportion of petroleum to total imports increased substantially both years. As a result of larger quantities and higher prices for fuels, India's bill in 1979 was estimated at $3.5

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billion representing a 75% increase over the previous year. India's petroleum import bill could rise to around $4.6 billion in 1980, and equal to about 50% of the total value of exports. Iran dropped from first to third place as a supplier of crude oil in India in 1979. Iraq became the major supplier, with 6.5 million tons and Saudi Arabia in second place with 3.0 million tons.

Other major mineral imports were iron and steel, precious and semiprecious stones, fertilizers, and nonferrous metals, in that order. The relatively large increases in receipts of each of these categories, except the gems, were a direct result of domestic production shortfalls caused by the electric power, coal, and tranport problems. The rough gems were imported mainly from Switzerland and London for cutting and polishing and later reexport.

Table 2.—India: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1976	1977
METALS			
Aluminum:			
Bauxite and concentrate		21,190	35,796
Oxide and hydroxide		40,699	1,838
Metal including alloys:			
Unwrought		34,814	1,471
Semimanufactures		6,357	13,375
Cadmium metal including alloys, all forms		45	5
Chromium ore and concentrate		277,798	167,086
Copper:			
Copper sulfate		(1)	4
Metal including alloys:			
Unwrought		(1)	8
Semimanufactures		691	357
Iron and steel:			
Iron ore	thousand tons	22,990	22,845
Iron ore concentrate	do	414	347
Metal:			
Scrap	do	218	182
Pig iron, shot, pellets	do	856	854
Ferroalloys:			
Ferrochrome		4,823	10,086
Ferromanganese		24,154	19,300
Ferrosilicon		8,316	4,249
Steel ingots and equivalent primary forms	thousand tons	296	392
Semimanufactures:			
Bars, rods, angles, shapes, sections	do	948	590
Plates and sheets	do	15	19
Hoop and strip	do	(1)	1
Rails and accessories	do	77	90
Wire	do	3	6
Pipes, tubes, fittings	do	230	282
Castings and forgings, rough	do	6	9
Lead:			
Oxides		23	249
Metal including alloys, all forms		170	20
Manganese:			
Ores:			
First-grade ore		29,812	NA
Second-grade ore		222,270	NA
Ferruginous manganese ore		462,356	NA
Total		714,488	534,536
Manganese oxide		24	653
Nickel metal including alloys, all forms		5	11
Selenium, tellurium, arsenic, silicon		(1)	41
Silver metal including alloys	thousand troy ounces	40,875	16,706
Tin metal including alloys, all forms		27	61
Tungsten metal including alloys, all forms	kilograms	7	500
Zinc:			
Oxide		235	875
Metal including alloys, all forms		9	20
Other:			
Ores and concentrates of titanium, vanadium, and zirconium		121,027	60,394
Ores and concentrates of rare-earth metals		r4,122	3,077
Oxides and hydroxides		300	150
Metal-bearing residues		458	443
Base metals including alloys, all forms		r102	13

See footnotes at end of table.

Table 2.—India: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
NONMETALS		
Abrasives:		
Natural emery, crude	32	NA
Dust and powder of natural and synthetic gem stones, except diamond	220	556
Grinding and polishing wheels, stones, powder	2,122	2,019
Natural abrasives, n.e.s	117	789
Asbestos	49	340
Barite and witherite	151,426	177,177
Boron materials: Boric acid	146	278
Cement, hydraulic	619,728	446,958
Chalk	1,167	397
Clays and clay products (including all refractory brick):		
Crude:		
Ball clay	--	28
Bentonite	12,631	18,538
Earth clay	(1)	316
Fire clay	266	150
Fuller's earth	21	1,332
Kaolin	3,778	5,265
Other	889	2,115
Products:		
Refractory (including nonclay refractory products)	16,681	16,526
Nonrefractory	[2]16,599	31,789
Diamond, gem:		
Uncut value, thousands	$109	$1,506
Cut do	$209,303	$423,311
Feldspar	11,983	14,647
Fertilizer materials: Ammonia, anhydrous and aqueous value	$2,390	$3,805
Gem stones, except diamond:		
Natural:		
Uncut:		
Emerald value, thousands	$645	NA
Feldspar do	$3,802	NA
Cut do	$19,028	NA
Total do	$23,475	$22,911
Synthetic and reconstituted:		
Uncut do	$51	$153
Cut do	$1,823	$320
Graphite, natural	14	44
Gypsum and plasters	974	11,182
Kyanite and related materials:		
Kyanite:		
Calcined	5,295	2,778
Other	6,096	6,052
Sillimanite	455	550
Other	26	1,314
Lime, hydrated, and quicklime	5,383	8,851
Magnesite:		
Crude	106	3,105
Calcined, excluding dead-burned	7,790	8,697
Dead-burned	342	1,276
Mica:		
Crude:		
Blocks	889	1,047
Condenser film	146	67
Splittings	3,530	3,612
Scrap and waste	8,055	9,958
Manufactured:		
Condenser film plates	4	36
Washer discs	151	286
Cut sheets and strips	47	62
Micanite and other built-up mica	33	80
Powder	9,239	7,505
Other	53	120
Pigments, mineral:		
Natural, not further described	331	NA
Iron oxide	3,215	5,233
Salt	356,984	244,323
Sodium and potassium compounds, n.e.s.:		
Caustic soda	3,759	2,910
Caustic potash	344	583

See footnotes at end of table.

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Table 2.—India: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
NONMETALS —Continued		
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked:		
Slate	1,101	1,690
Marble	1,345	2,326
Other	150,060	170,296
Worked, all types	4,231	11,298
Gravel and crushed rock:		
Dolomite	5,945	7,497
Limestone for lime manufacture	219,172	137,657
Quartz	6,520	8,328
Other	1,252	15,123
Sand, excluding metal bearing	229	418
Sulfur:		
Elemental	322	821
Sulfuric acid	989	1,784
Talc, steatite, soapstone	8,785	18,001
Other:		
Crude	3,791	NA
Slag and waste, not metal bearing	622	30
Oxides and hydroxides of magnesium, strontium, barium	370	178
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	17,195	380
Carbon black	3,306	4,390
Coal:		
Bituminous	470,220	629,429
Other	7,308	NA
Coke	24,313	11,157
Petroleum refinery products:[3]		
Gasoline thousand 42-gallon barrels	NA	NA
Kerosine and jet fuel do.	NA	NA
Distillate fuel oil do.	NA	NA
Residual fuel oil do.	546	NA
Lubricants do.	NA	NA
Other do.	NA	367
Total do.	NA	NA
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,305	35

[r] Revised. NA Not available.

[1] Less than 1/2 unit.

[2] Excludes quantity valued at $89,440.

[3] Data are from the International Petroleum Annual, 1976 and 1977. Official trade statistics do not report petroleum refinery products under the categories listed. Instead, all products are listed in three categories as follows, with quantities given in metric tons (not barrels): 1976—light distillates, 28,666; medium distillates, 52,778; and other, 65,046; and 1977—light distillates, 20,467; medium distillates, 49,023; and other, 51,089.

Table 3.—India: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum:		
Alumina	361	524
Metal including alloys, all forms	2,029	4,900
Antimony:		
Ore and concentrate, gross weight	1,523	1,453
Oxides	45	126
Metal including alloys, all forms	46	518
Arsenic:		
Crude sulfides	8	21
Oxide and acid	836	705
Elemental	22	24
Beryllium metal including alloys, all forms kilograms	615	369
Bismuth metal including alloys, all forms	2	19
Cadmium metal including alloys, all forms	([1])	6
Chromium:		
Oxide and hydroxide kilograms	400	--

See footnotes at end of table.

Table 3.—India: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS —Continued		
Chromium —Continued		
Metal including alloys, all forms	61	25
Cobalt:		
Oxide and hydroxide	7	5
Metal including alloys, all forms	59	138
Copper metal including alloys:		
Scrap	7,113	16,305
Unwrought	31,185	26,746
Semimanufactures	2,515	4,071
Iron and steel:		
Iron ore	178	1,087
Roasted pyrite	3	16
Metal:		
Scrap	28,135	45,073
Pig iron, sponge iron, powder	535	1,038
Ferroalloys	794	813
Steel ingots and equivalent primary forms	12,372	4,794
Semimanufactures:		
Bars, rods, angles, shapes, sections	58,688	56,953
Sheets and plates	255,956	314,812
Hoop and strip	15,452	11,916
Rails and accessories	25	639
Wire	2,679	2,576
Pipes, tubes, fittings	88,026	120,258
Castings and forgings, rough	5,859	2,057
Lead:		
Ore and concentrate	145	20
Oxide	18	3
Metal including alloys:		
Unwrought	46,144	46,637
Semimanufactures	235	556
Magnesium metal including alloys, all forms	296	205
Manganese:		
Ore and concentrate	190	5,048
Oxides	38	279
Metal including alloys, all forms	57	218
Mercury 76-pound flasks	9,531	9,692
Molybdenum metal including alloys, all forms	106	15
Nickel metal including alloys:		
Scrap	852	1,227
Unwrought	2,792	4,756
Semimanufactures	1,731	1,244
Platinum and silver:		
Waste and scrap	12	--
Platinum metal including alloys, unwrought and semimanufactures troy ounces	18,022	12,386
Silver metal including alloys, unwrought and semimanufactures do	56,814	30,191
Rare-earth metal ores and concentrates	[r]167	27
Selenium, elemental	2	81
Silicon, elemental	605	485
Tantalum metal including alloys, all forms kilograms	180	3,320
Tin:		
Oxide, hydroxide, peroxide	56	497
Metal including alloys:		
Scrap	4,127	2,995
Unwrought	3,111	2,359
Semimanufactures	3	100
Titanium oxide	4,068	4,756
Tungsten:		
Ore and concentrate	500	403
Metal including alloys, all forms	34	14
Zinc:		
Ore and concentrate	38,493	19,001
Oxide	11	17
Dust	590	NA
Metal including alloys:		
Unwrought	47,829	62,156
Semimanufactures	688	[2]1,816
Other:		
Ores and concentrates of columbium, tantalum, molybdenum, vanadium, zirconium	90	452
Scrap and waste	1	21
Metalloids	23	NA
Base metals including alloys, unwrought and semimanufactures	581	516

See footnotes at end of table.

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Table 3.—India: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
NONMETALS		
Abrasives:		
Tripoli earth	2	122
Dust and powder of natural and synthetic gem stones, except diamond ... kilograms	546	229
Grinding and polishing wheels and stones	464	495
Natural abrasives, n.e.s	2	1
Asbestos	47,167	65,786
Boron materials:		
Crude, natural	11,498	6,000
Boric acid	3	6
Bromine, elemental	230	528
Cement	702	336
Clays and clay products (including all refractory brick):		
Crude	10,000	8,161
Products:		
Refractory	10,903	3,023
Nonrefractory	249	30
Cryolite and chiolite	4,062	350
Diamond:		
Gem ... value, thousands	$156,252	$329,049
Industrial ... thousand carats	480	775
Diatomite: Kieselguhr and other infusorial earth	1,251	980
Feldspar and fluorspar	1,000	4,703
Fertilizer materials:		
Crude, natural: Phosphate rock ... thousand tons	472	2,309
Manufactured:		
Nitrogenous:		
Ammonium nitrate, ammonium sulfate, and urea, N content ... do	974	NA
Other, gross weight ... do	43	NA
Total N content ... do	NA	1,199
Phosphatic	5,028	NA
Potassic	258,876	731,728
Mixed	30,894	221,020
Gem stones, except diamond:		
Natural ... value, thousands	$7,142	[illegible]
Synthetic and reconstituted, uncut ... do	$65	[illegible]
Graphite, natural	647	696
Gypsum and plasters	45	22
Iodine, elemental, except colloidal	97	225
Lime, hydrated, and quicklime	9	4
Magnesite, crude	--	30
Mica, worked	30	56
Pigments, mineral:		
Iron oxide	1,063	2,420
Other	152	27
Pyrite, gross weight	6	NA
Salt	252	564
Sodium and potassium compounds, n.e.s.:		
Caustic soda	50	101
Caustic potash and sodic and potassic peroxides	196	1,504
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	66	19
Worked ... value	$1,111	$37,719
Dolomite, chiefly refractory grade	2	--
Gravel and crushed rock:		
Quartz	([3])	3,778
Other	8	NA
Sulfur:		
Elemental	588,741	767,305
Sulfuric acid	([1])	1
Talc, steatite, soapstone, pyrophyllite	11	--
Other:		
Crude ores	9,717	NA
Slag and ash, not metal bearing	28	--
Oxides and hydroxides of magnesium, strontium, barium	107	297
Halogens, including mixed	NA	8
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	1,144	1,189
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	281	2,237
Carbon black and gas carbon:		
Carbon black	1,094	1,885

See footnotes at end of table.

Table 3.—India: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
MINERAL FUELS AND RELATED MATERIALS —Continued		
Carbon black and gas carbon —Continued		
Gas carbon	5	124
Coal, anthracite	35	2,805
Petroleum:		
Crude ... thousand 42-gallon barrels	98,753	109,739
Refinery products:[4]		
Kerosine and jet fuel ... do	5,324	8,068
Distillate fuel oil ... do	4,304	5,095
Residual fuel oil ... do	5,495	4,649
Lubricants ... do	350	161
Other ... do	1,340	2,205
Total ... do	16,813	20,178
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	3,294	834

[r] Revised. NA Not available.

[1] Less than 1/2 unit.

[2] Includes zinc dust.

[3] Value only reported at $30,275.

[4] Data are from the International Petroleum Annual, 1976 and 1977. Official trade statistics do not report petroleum refinery products under the categories listed. Instead, all products are listed in three categories as follows, with quantities given in metric tons (not barrels): 1976—light distillates, 185,122; medium distillates, 1,041,081; and other, 580,441; and 1977—light distillates, 524,061; medium distillates, 1,492,548; and other, 351,298.

COMMODITY REVIEW

METALS

Bauxite, Alumina, Aluminum.—Indian bauxite production rose for the fourth consecutive year in 1978 but probably showed a small decrease for 1979. Over 60% of this production came from the States of Bihar and Madhya Pradesh with most of the remainder coming from States bordering Madhya Pradesh. A marked change in this production pattern is expected if three new export-oriented alumina plants proposed for Andhra Pradesh, Orissa, and Gujarat come into production in the 1980's.

Bauxite was produced at 67 active mines, 15 were captive mines of the aluminum companies with 3 in the public sector and 12 in the private sector. Of the 52 noncaptive mines, only 2 were in the public sector. Nearly 75% of the bauxite production was consumed by the aluminum industry. The balance was used by the chemical, refractory, abrasives, cement, and steel industries. A small amount of bauxite was exported.

Present estimates place India's bauxite reserves, fifth in the world, at 2,300 million tons or about 10% of world reserves. Nearly 75%, or about 1,700 million tons are located along the east coast in Orissa and Andhra Pradesh. Most of the remainder are found in Madhya Pradesh, Gujarat, and Maharashtra.

According to GSI, the east coast deposits alone could be as high as 3.0 billion tons. They are rich in gibbsite and low in silica. Steps were underway to classify known deposits by grade and to explore additional areas.

Alumina production made a modest gain in 1978 then lost most of the gain in 1979 because of the power shortages at the smelters. However, a large increase in production is anticipated over the next decade should the three proposed export-oriented alumina plants become a reality. The public-sector Bharat Aluminum Co. (BALCO) is considering setting up two east coast aluminum plants, one in Koraput District in Orissa and one in Visakhapatnam District in Andhra Pradesh. Detailed feasibility reports on each project were submitted by experts from France and the Soviet Union. Although these recommended establishment of plants, no major investment decision was likely before the beginning of the new year. The French report recommended establishment initially of an 800,000-ton-per-year alumina plant, a 220,000-ton-per-year aluminum smelter, a 600-to-800-megawatt captive powerplant, and an 80,000-ton-per-year caustic soda plant. Cost of the project was estimated between $1.0 and $1.5 billion. Inclusion of the

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captive powerplant and a guaranteed coal supply are mandatory, considering the electric power situation, if the plant is to be economically viable. Ore would be supplied by mining the 360-million-ton Panchpatmali deposit. The plant would be built at Damonjodi, 23 kilometers from Koraput. The project must be reviewed and passed by several government groups, then by the Public Investment Board and, finally, by the Cabinet before work can begin. The French firm Pechiney Ugine Kuhlmann, which did the feasibility study for the project, has the inside track on getting the design and consultants' contract when the plant is approved.

Plans for the U.S.S.R.-backed 600,000-ton-per-year Andhra Pradesh alumina project were not as well advanced as the Orissa project. MEC began a detailed exploration of the bauxite reserves at the Jerralla deposit in Visakhapatnam District. These reserves, on which the proposed alumina plant will be based, total about 200 million tons proved ore. The Russian plan appears to be bogged down in financing and equipment supply negotiations. Government of India (GOI) prefers to manufacture and supply as much of the equipment domestically as possible. The Soviets proposal called for 100% imported components. Unlike the Orissa project, this development would not include smelting facilities.

In 1978 the GOI cleared a proposal by the Gujarat Mineral Development Corp. to retain Hungarian experts to make a detailed feasibility study for an export-oriented 300,000-ton-per-year alumina project, based on a 50-million-ton bauxite deposit in Kutch District, Gujarat. The study was being completed at yearend 1979.

Exports to date have been small and generally consist of surplus production from BALCO and Indian Aluminum Co. Ltd. (INDAL). The power shortages, however, left a larger than normal surplus and alumina exports by BALCO were nearly 75,000 tons in FY1978-79. BALCO expects to have about 50,000 tons available for export in 1979-80. INDAL exported about 15,000 tons to the U.S.S.R. in 1978.

Aluminum production in 1978 from the four aluminum companies picked up modestly over 1977. Despite this increase, capacity utilization improved only marginally from 69% in 1977 to 76% in 1978, due primarily to the electric power situation. Madras Aluminum Corp. Ltd. (MALCO) in Tamil Nadu operated at 92% of its 25,000-ton-per-year rated capacity, reflecting the relatively better power situation in southern India. BALCO, the public sector company, operated at only 34% of its 100,000-ton-per-year capacity. Fifty percent of its capacity has never operated since its completion in 1977. Hindustan Aluminum Corp. Ltd. (HINDALCO) at Renukoot operated at 66% of its 100,000-ton-per-year capacity, almost entirely off its own captive thermal powerplant.

In 1979, the general power situation worsened and production dropped back to around 1977 levels.

Total installed capacity was 321,000 tons per year for the four aluminum companies. HINDALCO plans to install a new 20,000-ton-per-year potline by FY1982-83. The long-term expansion prospects for the industry look promising in view of existing bauxite reserves and abundant labor. By the year 2000, India's capacity could reach 1 million tons per year. However, the restraining and very crucial factor remaining to be resolved is the power supply.

As industrial activity picked up during 1978, the demand for aluminum was also strong, outpacing production by a wide margin. Consumption in FY1978-79 was estimated at 240,000 tons. Demand was projected to rise to 275,000 tons in FY1979-80, 300,000 tons in FY1980-81, and 330,000 tons in FY1981-82. At least 52% of domestic demand was from the electric power industry. With the GOI giving priority to increasing demand for electric-cable-grade aluminum.

Because of the widening gap between domestic supply and demand, imports have increased considerably. Although the 1979 gap was projected at 35,000 tons, plans called for the import of about 75,000 tons, in part to rebuild inventories. Assuming that projected demand materializes, the GOI will have no alternative but to rely on expensive imports for at least the next several years. Aluminum imports through April 1979 were channeled through BALCO. However, the GOI shifted this responsibiliby on May 1 to the Minerals and Metals Trading Corp. (MMTC) because of the increased quantities of imports. Exports of aluminum have been banned since August 1977.

Aluminum prices are fully controlled by the GOI, and financial returns allowed were reportedly quite small. To compensate the producers for cost increases because of higher electricity charges, the Government allowed prices to rise on October 1, 1979. The price of electric-cable-grade ingot was raised from $1,550 per ton to $1,781 per ton and commercial grade from $1,532 per ton to $1,715 per ton.

Chromite.—The Orissa Mining Corp. (OMC) has been issued a Letter of Intent by the State of Orissa to construct a 50,000-ton-per-year charge chrome plant at a cost of approximately $33 million. Two groups have submitted bids but the contractor had not been selected at yearend 1979. The plant would be based on a feedstock of chrome ore fines and would be primarily geared for export, but about 15,000 tons per year would be diverted to the Durgapur alloy steel plant which is to be modified to accept charge chrome.

Proposals for establishing two more 50,000-ton-per-year charge chrome plants have been made. One, by the Ferroalloys Corp., based on technology developed in their own works at Garividi, will probably be approved. The second application was made by Indian Metals and Ferroalloys Ltd., also for location in Orissa. This project was in the early stages of planning.

The primary reason for the new interest in the chromite processing industry has been the changing reserves picture. Based on several years of GSI and MEC intensive field work, proved chromite reserves now total 60 million tons of over 30% Cr_2O_3 ore or roughly twice the previous estimate. About 80% of the new reserves are concentrated in the Sukinda area of Cuttack District, 10% in neighboring Dhenkanal District, and 10% in Keonjhar District of Orissa. Breakdown by grade was not yet available, but a large percentage of the new reserves was in the form of fines. The inventory by GSI and MEC was continuing at yearend 1979. When completed it was expected that the reserves figure will exceed 100 million tons. The increase in the reserves tonnage was due in large part to changing specifications of what was considered usable ore. Production of charge chrome allows a lower chromium content, lower chromium-iron ratio, and use of smaller particle sizes.

Indian chromite production, 90% of which came from the mines in Orissa, declined in value from $20 million in 1977 to $16 million in 1978. This was attributed to a slowdown in iron and steel production in the country as well as recessionary conditions in the international market which adversely affected exports. Production in 1979 was believed to have increased slightly. Chromite exports in 1978-79 were at the lowest level since 1969. The slump was attributed chiefly to a cutback in Japanese steel production which accounts for 90% of Indian chromite exports. Because of this, India has attempted to deversify its export market. During the past year some ore was shipped to Western Europe and a small amount to China on a trial basis.

According to the GOI 1979-80 Export Policy, high-grade lump ore containing 40% Cr_2O_3 or more continued to be banned for export, while concentrate produced from beneficiation of low-grade ore continued to be exempted to encourage export of low-grade chromite.

Copper.—During 1978 and 1979 copper demand outstripped production by a wide margin. Production was off substantially in 1978 then made a modest recovery in 1979. As a result of the lower production, imports of copper metal increased considerably in 1978 and their cost increased to $55 million from $31 million in 1977. India's major suppliers were Zambia with 24,000 tons followed by the Federal Republic of Germany 12,000 tons, and Tanzania 3,000 tons. For FY1978-79, MMTC which contracts for most of India's imports, reportedly contracted for 83,000 tons of copper compared with over 35,000 in the previous year. This increase was designed in part to rebuild inventories. As of March 1979, MMTC's stocks were only about 20,000 tons. Because of underutilization of capacity and continuing problems at the Khetri complex, production cost during 1978 exceeded the price of imported metal.

Production at the Khetri smelter ran below 40% of its rated capacity in both 1978 and 1979. Various problems have plagued the Khetri complex since its completion in late 1974. Latest of the troubles were a 53-day strike which closed the plant until April 20, 1978, a 4-month closing during 1978 while technical improvements were being made, and an 80-day closing beginning in August 1979 because of recurring problems with the flash smelter furnace. Compounding the smelter problems has been a lower than anticipated copper content in the ore from the mines supplying the concentrator. These have been running about 0.6% Cu instead of the 1.0% as planned.

To improve recovery and production of copper, plans call for installation of balancing facilities at both the existing smelters and upgrading of the concentrate treated at

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Khetri above the present 12%.

In an effort to decrease the amount of copper imported, India was continuing with a strong exploration and development program. Foremost in the plans is the Malanjkhand project in Balaghat District of Madhya Pradesh. The project will consist of a 2-million-ton-per-year mine and a matching concentration facility. The concentrate, with a planned content of 23,000 tons per year of copper, would be shipped to Khetri for smelting and refining. Estimated cost of the project was well over $100 million. Proved reserves are 15 million tons at 1.0% Cu and estimated ore was put at 60 million tons. The project suffered delays in getting started but preliminary work and infrastructure development got underway in late 1978. Actual construction on the concentrator and open pit mine reportedly began in July 1979. The original planned startup date of October 1981 has been pushed back to FY1982-83.[11]

Iron Ore.—Iron ore production declined in 1978 for the second year in succession, again because of a drop in demand from the export market. Despite the considerable drop in tonnage the pithead values remained nearly constant at about $110 million. With a pickup in the export market in 1979, the Goan ore production did a sharp turnaround and increased over 4 million tons.[12] India remained the seventh largest iron ore producer in the world for both years and only coal and petroleum were of more value in the mineral sector.

In early 1979, the area around Goa produced over one-third of the Indian iron ore total, nearly all of it for the export market. Most of the remainder of production came from Madhya Pradesh, Orissa, and Behar where many of the integrated steel plants are located.

The 5-year plan (1978-83) calls for a production of 65 million tons by FY1982-83, reaching 77 million tons by FY1987-88. At the 1987-88 level, hematite reserves are sufficient to last about 125 years and magnetite reserves over 100 years, according to the plan. India's officially estimated iron ore reserves were put at 17 billion tons.[13] These reserves represent India's second most valuable mineral asset after coal.

MMTC accounts for about 60% of the iron ore exports each year with the remainder coming from the private mining-shipping companies of Goa. Despite recessionary conditions in the world steel market during FY1978-79, exports increased slightly over FY1977-78, but export earnings remained basically unchanged at about $297 million. The 1979-80 export earnings should be considerably higher because of new agreements reached between Japan and MMTC and Goan exporters. Japan continued to be India's main customer, with Eastern Europe, South Korea, Iraq, Taiwan, and Holland also receiving substantial amounts. China and the United Arab Emirates received Indian exports for the first time in 1978. A contract was signed in late 1979 for the sale of 300,000 tons of iron ore to the Democratic Republic of Korea. The shipments will be made in Korean ships on their return journeys from delivering cement to India. This will be the first India iron ore shipped to North Korea. At yearend 1979, Pakistan and India were negotiating the possible sale of ore to supply Pakistan's first blast furnace scheduled for completion at the end of 1980. India has a distinct advantage in lower transportation costs to Pakistan over other potential suppliers.

The new automated ore-handling facilities at Mormugao Harbor in Goa were ready to begin commercial operations in October 1979 after a 1-year period of trial operations. The previous partly manual and outdated ore-loading facilities have been a bottleneck to ore exports in the past. The new facility, which cost over $100 million, was begun in 1973 and will greatly increase the efficiency and speed of ore transfer at the Goan port. Since 90% of the ore is transported to the harbor in barges, a major part of the facility is the waterborne-ore unloading equipment. There are four barge-unloading bays, each with two 12-ton grab buckets. The sustained unloading capacity is 2,400 tons per hour. Belt conveyors move the ore through transfer houses to three surge bins. From any of the bins, the ore can be routed to stackers for stockpiling or directly to shiploading. Two traveling bucketwheel reclaimers rated at 4,000 tons per hour each are employed to provide an average sustained flow of 3,000 tons per hour at the shiploaders. Automated rotary dumper equipment was also included to handle the ore shipments delivered to the port by the 1-meter-gage railroad line. The new ore berth was designed to handle vessels up to 120,000 deadweight tons but current draft limitations at the harbor mouth limit ships to a 12-meter draft or about 60,000 tons.

During 1978-79, India's domestic iron ore consumption remained unchanged at around 16 million tons accounting for about 42% of total production. For 1979-80, domestic iron ore consumption was estimated at around 17 million tons to meet the crude steel target of about 9 million tons. That estimate could be high considering the power and coal supply problems during 1979.

The public-sector NMDC was conducting exploration and feasibility studies on selected major iron ore deposits such as Kumaraswamy B and D ore blocks and the phase II section of the Bababudan deposit in Karnataka, Ongole, in Andhra Pradesh; and Bailadila 11B/10 ore blocks in Madhya Pradesh. Exploration of the magnetite deposits at Bababudan are expected to be completed by 1980 at a cost of nearly $1 million. Likewise, exploration of the magnetite deposits at Ongole, started in 1977, were to be completed by yearend 1979 at a similar cost. The Bailadila 11B/10 hematite deposits are being investigated as a possible ore supply for the planned Visakhapatnam steel plant.[14]

Construction work on the 7.5-million-ton-per-year Kudremukh iron ore concentrate project continued on schedule during 1978 and 1979. The first load of concentrate was scheduled to be shipped to Iran in September 1980. The ore was to be made into pellets in Iran and used as feed for two direct-reduction sponge iron plants. Because of political changes in Iran, work was stopped on one of the sponge iron plants, and construction on the pellet plant and remaining steel complex was considerably delayed. Iran has been financing the project at an original cost of $630 million but reportedly made only $255 million in payments. As of yearend 1979, Iran was likely to take only 4.5 million tons per year of concentrate starting many months after Kudremukh's scheduled startup. India was reviewing a number of complex and expensive options available for utilizing the surplus production capacity. Construction of a pellet plant at Mangalore is a distinct possibility. The pellets could then be exported or shipped north where direct-reduction plants based on Bombay High natural gas could be constructed. Whatever solution is found will cost several years' delay in Kudremukh's full utilization and a great deal of additional money.

Mandovi Pellets Ltd. at Goa, India's third and largest iron ore pelletization plant, was commissioned in May 1979. The plant has a capacity of 1.8 million tons per year and is jointly owned by the Steel Authority of India Ltd. and Chowgule Co. Pvt. Ltd. The output of the plant will be exported to Japan. Chowgule Co. also operates a 0.5-million-ton-per-year pellet plant at Pali, Goa. The only other plant in India is operated by the Tata Iron and Steel Co. for its own steel mill. NMDC was negotiating for a 2.0-million-ton-per-year pellet plant to be set up at Bailadila to utilize the high percentage of fines produced at these mines. However, considering the Kudremukh situation, the plant could be located at Mangalore instead.

Iron and Steel.—India's shortage of low-ash coking coal has led to a conservative attempt at developing a sponge iron capacity based on low-quality noncoking coal. After careful consideration, the India Government has authorized construction of a 30,000-ton-per-year pilot plant near Kothagudam, Khammam District, Andhra Pradesh. The $22 million plant is based on the Lurgi SL/RN technology and is expected to be operating in 1980.

In May 1979 the Tor-Steel Research Foundation, in collaboration with the Government of Orissa and Allis Chalmers Co. (United States), was given permission to start work on the country's second plant. The $30 million plant will have a capacity of 150,000 tons per year and will be located in Keonjhar District, Orissa. It is scheduled to go onstream in 1981.

Plans were being made for additional plants which would be located along the western coast and would utilize the natural gas from the offshore fields as fuel and reductant.

Steel shortages in India remained a problem for the second year in succession. A negligible growth of Indian crude steel production against a continuation of the recent annual rise of 16% in domestic steel demand increased the steel deficit and accelerated imports of steel. Indian prices were increased 20% to 40%. There was little relief in sight from the serious shortages of coking coal and electric power which affected the last 2 years' domestic output. Imports of finished steel more than doubled in 1978 and will probably double again in 1979. India lost its status of net steel exporter in FY1978-79 after just 3 years in that status, and will continue to import more steel than it exports until the rather formidable problems are resolved.

Production of steel in various categories all showed nominal gains in both FY1977-78 and FY1978-79. The Ministry of Steel and Mines imposed an 8% production cutback in April 1979 in an effort to rebuild danger-

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ously low coking coal stock levels and this apparently helped stabilize production output to some extent. By yearend 1979, production of crude steel ingots had recorded a small rise over the previous year but the electric power shortage in the rolling and finishing plants caused a decline in the production of salable steel at the integrated plants. In December 1978, capacity utilization hit a yearly high of 98% at Rourkela and 93% at Bhilai.[15]

Average rate of capacity utilization of salable steel by the six integrated producers fell from 81% in FY1977-78 to 77% in FY1978-79. Moreover, actual production fell short of the official production target by 18%. One of the main causes of the decline was in coal supply. Coal stocks at the steel mills were equivalent to 3 weeks' consumption in early 1977, fell to 10 days' supply in early 1978, and 2 to 4 days' supply in early 1979. The more than 20% ash content of the coal also hurt the blast furnace operations. Flooding in West Bengal in September 1978 affected production at the Durgapur and India Iron and Steel Co. mills. The omnipresent power problem was being solved in part by a direct approach. GOI approved construction of five captive 60-megawatt thermal power generators. Three will be installed at Bokaro and two at Durgapur.

What production gains there were in 1978 and 1979 were attributed mainly to the additional output of the mini-steel mills, which represent an aggregate of about 25% of national capacity. The 108 operating electric furnace mills in the private sector increased crude steel production from 1.0 million tons in FY1977-78 to 1.5 million tons in FY1978-79. Despite power problems, their capacity utilization jumped from 50% to 75% in that period. In addition to the encouragement from higher steel prices and demand, the following GOI concessions aided these private mills:

1. Removal of excise duty on steel ingots-rolled products.
2. Tax exemption on certain types of scrap from the integrated mills.
3. Removal of customs duty on imports of ferrous scrap.
4. Permission to make a wider range of products, including some grades of alloy steel.
5. Freedom to coordinate operations with the 200 private rerolling mills.[16]

In anticipation of a sustained annual growth of domestic demand between 15% and 20%, official production targets for the six integrated steel mills in FY1979-80 have projected a 15% increase in total production of steel ingots to 9.3 million tons and to 7.4 million tons for salable steel. These targets were unlikely to be fulfilled; actual production for the first quarter of FY1979-80 came to 17% below the goal. Considering the coal and power situation, it will be very difficult to make up the first quarter loss, let alone show a marked production increase.

Indian imports, primarily funneled through Steel Authority of India, Ltd. (SAIL), more than doubled in volume and increased 130% in value in FY1978-79. A sharp increase in imports of rolled and cold-rolled steel, plates, sheets, and structurals resulted from domestic shortages and from further relaxation of the GOI Import Trade Control Policy for 1978-79.

Indian exports of steel products in FY1978-79 fell sharply in volume and were valued at $134 million versus a value of $233 million the previous year. Export earnings for pig iron were valued at an additional $62 million. The GOI reimposed severe restrictions on steel exports and only shipments filling previous firm contracts were permitted. Most of those shipments that were permitted went to the Middle East, North Africa, and small Asian countries.

Japan, the Federal Republic of Germany, and the United Kingdom probably accounted for about three-fourths of the total Indian imports in FY1978-79. The United States, the U.S.S.R., and a few East European countries supplied the remainder. The United States, however, continued to be a major supplier of steel scrap to India and accounted for about 80% of the total.

By the end of 1979, steel imports had increased to the extent that Indian port facilities were inadequate to unload and clear the cargos on a timely basis. Besides the reported stockpiles at the ports—50,000 tons at Visakhapatnam, 39,000 tons at Madras, and 13,000 tons at Cochin—ships carrying a further 38,000 tons were waiting at these ports for unloading. Bombay and Calcutta were also seriously congested, further affecting the steel trade.

The GOI planned for a rapid expansion of the domestic steelmaking capacity to meet the high demand and regain the position of net exporter of steel. According to the GOI Steel Ministry, the current crude steel capacity of 10.6 million tons per year for the integrated steel mills is to be increased to 14.6 million tons per year by 1982-83 and further to 20.6 million tons per year by

1988-89.

The Indian steel industry, with 80% of its capacity in the public sector, depends primarily on the GOI annual budget for its expansion funds. The FY1979-80 budget provided the Steel Ministry a total of $456 million, a 10% increase over the previous year. Almost 80% of the amount will go to accelerate the expansion programs already underway at the Bhilai and Bokara mills.

A sum of $193 million was provided in FY1979-80 to facilitate the ongoing expansion of the Soviet-aided Bhilai steel mill from 2.5 to 4.0 million tons per year. Total cost of the project, to be completed in June 1983, has increased to $1.4 billion. A further expansion of capacity to 5.5 million tons per year has been planned for completion in 1988. More than 100 Russian technicians were working at the site. Much of the work consists of modernizing existing equipment or operations and reworking the entire coking section.

A sum of $166 million was available in 1979-80 to facilitate the stage II expansion of Bokaro's annual capacity from 1.7 million tons per year to 4.0 million tons per year by December 1980. Construction of the second cold-rolling mill complex, at a cost of $375 million was scheduled for completion by December 1982, if there were no delays in equipment supply.

A significant development in FY1978-79 was a new Indo-Soviet collaboration agreement for the construction at Viskhapatnam of an entirely new integrated steel mill in the public sector. The new mill will have a 3.0-million-ton-per-year capacity of salable steel and cost an estimated $2.8 billion. Plant design and equipment will be from the U.S.S.R. The Soviet Union has offered a 250 million ruble credit and has agreed to take back pig iron from the mill in lieu of cash repayment. The plant will have India's largest blast furnace (3,200 cubic meters), 7-meter-high coke ovens, and continous casting lines. The detailed project report was underway in 1979 and work could begin in FY1980-81.

Other expansion or modernization projects underway or approved in FY1979-80 include:

1. Construction at Rourkela of a new cold-rolled grain-oriented silicon steel mill and modernization of the hot strip mill.

2. Installation of a 50-ton OBM/Q-BOP converter at Durgapur, the first in India.

3. Continued construction on the new stainless steel mill at Salem in Tamil Nadu.

4. Renovation of the blast furnace and coke ovens at Indian Iron and Steel Co.

5. Completion of the expansion of the Alloy Steel Plant at Durgapur from 100,000 to 160,000 tons per year by the end of 1979. Also approved at this plant was the additional expansion of capacity to 260,000 tons per year at a cost of $59 million. Adaptation of a new secondary ladle refining process, such as vacuum oxygen decarburization (VOD), has been proposed as well.[17] Despite the above plans and projects, increasing investment costs, and persisting shortages of basic inputs, including coking coal, electric power, refractories, and steel scrap, will continue to restrict and delay the planned expansion of the Indian steel capacity. While every effort will be made to complete these programs, some delays in planned completion schedules can realistically be expected.

Lead.—India's lead production increased in 1978 with the startup of the country's second lead smelter. The new plant, located at Visakhapatnam in Andhra Pradesh was to reach its 10,000-ton-per-year design capacity by mid-1979. The plant utilizes imported concentrates, but it was hoped that as Indian lead ore production increased the plant would eventually switch to domestic concentrates. The older, 8,000-ton-per-year smelter is located at Tundoo in Bhihar and operates on concentrate shipped from the Zawar mines in Rajasthan and Agnigundala in Andhra Pradesh.

Present lead demand is roughly three times domestic production and rising slowly. Little change in production is anticipated in the next few years, and imports will play an increasingly important role. Lead imports were valued at $9.6 million in 1978 and were expected to increase during 1979. Australia was the major suppplier.

An important development underway in 1979 was the Sargipalli Mine project in Orissa scheduled to begin operation in 1982. The project cost was estimated at $14.4 million and designed to produce 500 tons of ore per day. Construction of a concentrator was also approved.[18] The Orissa ore reserves were reported as 1.48 million tons at 6.8% Pb proved; 0.58 million tons at 6.5% Pb indicated; and 0.7 million tons at 6.6% Pb inferred.

Manganese.—India's manganese ore production from 327 mines declined substantially in 1978. Minehead value was $21 million, about $2 million less than in 1977. Production was affected by the general

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recessionary conditions worldwide. It was believed that 1979 production rose slightly.

The four States of Orissa, Karnataka, Madhya Pradesh, and Maharashtra accounted for 90% of the total output. About 50% of production was from 313 small mines, a few of which yield up to 35,000 tons per year each. The public-sector Manganese Ore India, Ltd. (MOIL), which operated mines in Madhya Pradesh and Maharashtra, continued to produce over 75% of all high-grade ore and over 25% of the country's total production.

MOIL made international inquiries regarding construction of an agglomeration plant at its Balaghat mines to provide sinter or pellet feed to a proposed 60,000-ton-per-year ferromanganese plant. One or two beneficiation plants are also being considered to recover the fines presently underutilized at the semimechanized mines. The upgraded fines will be used as feed in the agglomeration plant. Tenders were expected to be issued in 1980 for the agglomeration plant.

Present domestic demand for manganese ore is estimated at just over 1 million tons per year. If GOI's steel expansion plans are successfully completed, consumption could reach 2 million tons per year for 1990. Manganese ore exports have shown a downward trend in recent years due largely to reduced imports by Japan plus a growing internal demand.

Nickel.—Nickel ore reserves were estimated at around 138 million tons at a cutoff of 0.5% Ni. Most of these reserves were located in the Sukinda deposit in Cuttack District, Orissa. Unfortunately for India's plans of nickel self-sufficiency, detailed testing of the Sukinda laterite ore by Indian and foreign consultants has failed to develop an economic method of processing the iron-rich ore. Studies by various groups were still underway but prospects for development of the deposit in the near future were dim.

Several other nickel occurrences have been mentioned in the press recently but will need detailed exploration to determine if they have economic potential. A nickel-bearing magnetite occurrence was reported near Pukphur, Nagaland. Samples were sent to the National Metallurgical Laboratory, Jamshedpur, for assay and ore beneficiation tests. The Ministry of Steel and Mines reported the discovery of a nickel deposit, estimated at 9.7 million tons of ore grading 0.97% Ni, in the Similipal Area of Orissa. And finally, a nickel deposit in the Singhbhum Belt of Bihar was believed to be sizable.

India's requirements of about 5,000 tons per year of nickel metal were met totaly by imports which were valued at $22 million in 1978. Principal suppliers were the United Kingdom and Canada.

Tin.—India has been conducting an exploration program on the reportedly rich Tonkupal tin deposit in Bastar District of Madhya Pradesh. The survey has been supported by a United Nations Development Program grant of about $2.5 million. Information on the survey findings was not yet available, but the deposit has been described as rich in the Indian press.

Zinc.—India's zinc production rose significantly in 1978, the fourth consecutive yearly increase, and topped 50% of the yearly market demand for the first time in recent years. The Government-owned Hindustan Zinc Ltd. (HZL) reportedly also increased production in 1979 to 51,000 tons despite severe power shortages at its two smelters, Debari in Rajasthan and Visakhapatnam in Andhra Pradesh. The private-sector Cominco Binani Zinc Ltd. in Alwaye, Kerala, has a 20,000-ton-per-year rated capacity and provides the remainder of the primary Indian zinc output.

With the startup of the 30,000-ton-per-year Visakhapatnam smelter in 1977, India's installed capacity for primary zinc production stood at 95,000 tons per year. The domestic demand was projected to be 108,000 tons in 1979-80 and to increase slowly to about 126,000 tons in 1982-83. There were no immediate plans to expand the country's present production capacity because of the high capital cost and power-consuming nature of this industry. Imports therefore will continue to be essential for the forseeable future.

The planning commission's production targets were set at 73,000 tons for 1979 and 82,500 tons for 1980. Considering the power situation, it is unlikely that those figures will be met.

The major comsumers of zinc in the country include the Rourkela steel plant, the brass industry, die casting, and dry batteries. Consumption in FY1978-79 amounted to approximately 100,000 tons. In addition, secondary metal recovery was 25,000 tons.

Owing to the increase in production during 1978, the value of imports of zinc metal dropped to $27 million in contrast to $50 million in 1977. The long-term outlook, however, is for higher imports of zinc metal, scrap, and concentrates. During 1978, imports came primarily from Canada, the U.S.S.R., Australia, Zaire, and Zambia. Holland, the United Kingdom, and the Federal Republic of Germany were the major suppliers of scrap.[19]

During 1978, zinc-lead ore production, which came mainly from HZL's Zawar group of underground mines in Rajasthan, rose to 1.05 million tons or about 14% higher than in 1977. The target for 1979 was 1.15 million tons of ore, with further increases anticipated when the Rajpura-Dariba Mine becomes operational in 1982, and the Zawarmala mines in 1984 to 1985.

Developments at the Rajpura-Dariba Mine continued with the sinking of the 6.1-meter-diameter main shaft nearing the 300-meter level. In 1979 HZL reportedly awarded the contract for the new concentrator at the Rajpura Mine to Utkal Machinery Ltd., a subsidiary of Larsen and Toubro Ltd. Sala International AB of Sweden has agreed to do the basic engineering on the project, but a large part of the fabrication is to be done by Indian firms. The concentrator will treat 2,700 tons per day of lead-zinc ore and 400 tons per day of lead-zinc-copper ore in a separate stream.[20]

The zinc oxide plant at Visakhapatnam began trial operations early in 1979. The plant treats leach residue from the zinc circuit and slag from the lead circuit. With this startup the Vaskhapatnam complex was nearly complete. The second phase of the lead plant, a sintering operation, and a gas-cleaning section was to be completed by mid-1979.

Barite.—Indian barite production increased for the sixth consecutive year in 1978 and was valued at $2.2 million at the pithead. Production also increased in 1979 and plans called for doubling of recent tonnage levels by FY1982-83 and further increase to nearly 1 million tons by FY1987-88. The largest single deposit of high-grade ore in the world is located at Mangampet in Cuddapah District, Andhra Pradesh. Over 95% of the barite is mined in this and four other districts in Andhra Pradesh. Current output levels rank India second or third in world production of barite. The principal mine at Mangampet, operated by the State-owned Andhra Pradesh Mining Corp., was well mechanized by Indian standards and produced about 560 tons per day of ore during 1979. About 70% to 80% of the run-of-mine production was marketable ore containing +92% $BaSO_4$ and with a specific gravity of over 4.1. Noncommercial ore was stockpiled for possible future beneficiation. Plans call for production to be raised to 1,000 tons per day in the next few years.

India's 60 million tons of proved reserves for barite were reportedly the largest in the world. Total estimated reserves including inferred ore were on the order of 200 million tons.

Annual domestic consumption of barite totaled about 100,000 tons with the Oil and Natural Gas Commission accounting for roughly 70,000 tons and the chemical, paint, and rubber industries accounting for most of the remainder. Future consumption is likely to remain near current levels and substantial surplus therefore will be available for export.

During FY1977-78 exports of barite, primarily powder, were valued at $17 million. The major markets were the Middle East oil-producing States of Iran, Iraq, and Egypt. Under the new export policy for 1979-80 all exports are now channeled through MMTC. The policy, as subsequently amended, includes chemical-grade powder white, snow white, and super snow white. Up to May 1979 mine owners were permitted to enter into private export contracts. The export target for FY1979-80 was 300,000 tons.

Cement and Limestone.—Limestone production from 392 mines declined marginally in 1978 but minehead value dropped about 16% compared with 1977. Considering the projected expansion of the cement and steel industry, limestone consumption was projected to double to over 60 million tons per year in FY1982-83, and reach 79 million tons per year in FY1987-88.

Despite the low unit value, limestone accounted for about one-half of the total value of India's nonmetallic mineral production in recent years.

Indian limestone reserves were estimated at 63 billion tons with about 6 billion considered proved. Forty-eight billion tons were of cement grade. A 37-million-ton deposit of flux-grade limestone was recently proved at Jaggay-yapetta in Andhra Pradesh. Exploration continued in a number of areas for new reserves, particularly for flux and chemical grades, and to better delineate and assay the proved category of existing reserves.

The annual capacity of the Indian cement industry rose from around 21 to 23 million

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tons during the past several years, while demand has increased much faster, resulting in an imbalance between demand and supply. In addition, shortages of power and coal and the poor quality of the coal shipped affected capacity utilization which averaged 90% during 1978, then fell to about 82% in 1979. A marginal production increase in 1978 became a serious drop of 1.4 million tons in 1979. An ominous feature in the production decline was that nearly 1 million tons of the shortfall occurred in the last 5 months of the year.[21]

The problem of coal quality was particularly important for the cement industry. A significant portion of the total ash content of coal (ranging from 25% to 35%) is absorbed in the cement during firing, necessitating the use of higher grade limestone to maintain a given quality in the finished cement.

Demand for cement was about 22 million tons in 1978, and rose considerably during 1979. By yearend 1979 the Indian press was estimating the overall gap between domestic production and demand at 6 to 7 million tons.[22]

As a result of the shortages, imports by the State Trading Corp. in FY1978-79 increased fivefold over the previous year and were certain to increase again in FY1979-80. The major suppliers in 1978 were North Korea, South Korea, and Romania. Offers of cement from Sri Lanka and Indonesia were also under consideration.

Plans call for a substantial increase in capacity. Licenses and letters of intent have reportedly been issued for additional capacity totaling 25 million tons, of which about 5 million tons was expected to be in production by March 1980. The remaining additional capacity should bring the installed capacity to over 40 million tons by the next decade.

In May 1979 the GOI announced financial incentives for the plants to encourage production as well as to undertake expansion programs. The former price controls did not keep up with rising costs and hence left such a small profit margin that there was little incentive to put in new capacity. Under the new system, new or existing units undertaking expansion will receive a higher price for their product. Cement plants using furnace oil will also receive a subsidy.

To promote development in underdeveloped and inaccessible areas, GOI has offered strong financial incentives for the establishment of mini cement plants. The plants will largely be set up in remote areas where they will meet local demand and be limited in capacity to 66,000 tons per year. Since the announcement of the incentives, GOI has received 41 applications from throughout the country. These would have an aggregate capacity of 1.7 million tons per year in addition to the 1.0 million tons per year already created.

Diamonds and Gem Stones.—Domestic production of diamonds, from the Government-owned and operated Panna Diamond mines in Madhya Pradesh, accounted for only 2% of India's demand for rough stones. The 1978 production was valued at $1.2 million compared with $1.5 million in 1977. Production of other precious and semiprecious stones in 1978 included significant amounts of emerald and gem-quality garnet. Approximately 3,000 tons of industrial garnet was also produced in 1978.

India's small production of diamonds belied the importance of the industry in the economy. India was one of the world's major finishers of gem diamonds, particularly specializing in the very small stones. The value of diamonds, pearls, other gem stones, and jewelry exports was put at $682 million in FY1977-78 and $830 million in FY1978-79, with diamond accounting for over 92% of the value. That ranked diamond as India's principal export and accounted for about 13% of total exports in FY1978-79.

India's diamond industry was dependent on the import of rough diamond which was valued at $580 million in FY1978-79. India was negotiating with the U.S.S.R. and several African countries in an attempt to diversify its sources of rough diamond and become less dependent on Belgium and the United Kingdom. During the year the GOI established the Hindustan Diamond Co. with the objective of buying and distributing rough diamond to the small polishers. Three large diamond exporters from Bombay reportedly were planning on establishing jointly a modern, well equipped diamond finishing complex at Surat in Gujarat the major polishing center in India.

Fertilizer.—The fertilizer industry has shown impressive growth from a base of a few tens of thousands of tons in the early 1950's to a present nutrientwise consumption in 1978-79 of 3.4 million tons of nitrogen, 1.1 million tons of phosphorus (P_2O_5), and 0.6 million tons of potassium (K_2O). Since 1974 average annual growth of consumption has been over 12%. Much of the increase has been the result of a GOI promotional effort in selected districts to educate and train the farmers in the advantages and proper use of fertilizers. In addition, the growing use of high-yield crop varieties, a steadily increasing use of irrigation, and GOI-subsidized prices have all combined to further strengthen fertilizer demand.

The main natural fertilizer mineral produced in India was phosphate rock, valued at about $23 million in 1978. About 90% of this came from Rajasthan, which has the largest reserves in the country, estimated at 100 million tons. Production of the other phosphorus mineral apatite dropped in 1978 then remained at about the same level in 1979. Long-range production targets for phosphate rock and apatite are put at over 2 million tons for FY1982-83. Most of the phosphate increase was to come from the huge Jhamar Kotra deposit in Rajasthan where a 200-ton-per-day pilot plant for beneficiating the lower grade ore was under construction. The $1.7 million plant will be based on a froth flotation process developed by the Indian Bureau of Mines specifically for this type of highly abrasive rock. The process reportedly upgrades a sample from 13% P_2O_5 and 10% MgO to 35% P_2O_5 and 1.2% MgO with an 82% recovery factor. The plant was to be completed in 1980.

Based on the pilot plant's performance, a project report will be prepared for a 500,000-ton-per-year commercial plant to be set up at the mine at an estimated cost of $100 million. Additional advantages of the phosphate concentrator operation will be a reduction in the high silica content of the ore and a more uniform and more reactive feed for the phosphoric acid plants.

Another development in the phosphate industry was the interest expressed by Hindustan Zinc Ltd. in slurry pipeline transport of its phosphate rock from Maton Hill Mine a distance of 10 kilometers, to its smelter and phosphoric acid plant at Debari. Maton Hill Mine has the only phosphate rock beneficiation facilities in India. Plans are to double present capacity of the contractor to 600 tons per day.

Domestic production of phosphorus raw materials was not sufficient to meet demand of the fertilizer industry. As a result, roughly 60% of the requirements in 1978 were met by imports of rock phosphates from Jordan, Morocco, the United States, and Senegal. Firm orders for 1,750,000 tons plus options for another 205,000 tons were contracted for 1979. Estimated import requirements for 1980 were put at 2.0 million tons with the upward trend likely to continue as the demand for fertilizers steadily increases.

There was no commercial production of potash minerals in India in 1979, India's potash requirements are basically met through import of straight potassium chloride. The country is one of the biggest markets in the world for potash exporters, with only the United States, Poland, Brazil, and Japan buying more. Only three countries supplied the needed potash imports, the German Democratic Republic, the Federal Republic of Germany, and Canada. All purchases were made by MMTC. Marketing within India is done by Indian Potash Ltd. of Madras, a joint public-private sector company.[22]

In an effort to relieve the import dependency, the GSI started a potash exploration program in 1974 and has continued the work through 1979. The survey identified and delineated a 30,000-square-kilometer area, from the Nagaur Basin in Rajasthan to Satipuur in Haryana, as a potential zone of potash exploitation. So far, discoveries in the Lakhasar area in Churu District (4% to 8% potash) and in Gossainnagar and Bikaner have been reported. A new high-capacity drilling rig was added in 1979 to the exploration effort which will be continued on a priority basis.

Production of nitrogenous fertilizers was well below the 3.26-million-ton contained nitrogen capacity of the industry in 1978-79. The overall capacity utilization was less than 70%, and a small improvement over the 65% recorded in 1977-78. One major problem with the existing plants reportedly has been a poor maintenance record often leading to production stoppages. A Government survey concluded that from one-third to two-thirds of the total capacity loss was directly attributable to maintenance inefficiency. The remainder coming from a combination of transportation bottlenecks, raw material shortages, labor problems, and the power shortages.

Several new ammonia units came into production in 1979 and several others were beginning shake-down trials at yearend. The most important of these were the twin coal-based ammonia-urea plants at Talcher and Ramagundam. The 900-ton-per-day N ammonia plants use domestic high-ash coal as feedstock and are among the largest of that type in the world.

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Major new ammonia-urea capacity expansion will be undertaken using the Bombay High natural gas as feedstock. Four 1,350-ton-per-day urea plants will be constructed. The proposed location of these plants has been highly controversial but it was finally decided in 1979 that two of the units will be set up at Thal-Vaishet about 21 kilometers south of Bombay. The other two plants will be at Hajira, near Surat in Gujarat State. Construction could begin in 1980.

Mica.—Crude mica production continued an 8-year downtrend in tonnage although value increased marginally in 1978 because of higher prices. Bihar accounts for about 50% of total production and Andhra Pradesh and Rajasthan supply most of the remainder. The decline is because of general changes in market conditions and increased mining costs of an essentially cottage industry.

Despite the officially reported decline in production, mica exports rose by 1,000 tons in 1978, and the value remained basically unchanged.

According to the Indian FY1979-80 Export Policy, exports of processed mica products were no longer subject to Government export control, but only to GOI posted prices. Export duty on mica as of April 1978 ranged between 10% and 30% depending on grades.

Domestic consumption remained small but growing. A number of mica-based industries have been established or planned by the GOI Mica Trading Corp. (MITCO) in an effort to diversify and add to the value of the export trade. MITCO has set up a small, dry-ground mica powder plant at Jhumritalaya in Bihar. Under consideration were plants for micronized powder, wet-ground mica, and mica paper and paper-based products.

MINERAL FUELS

Petroleum and Natural Gas.—India continued to be about 60% dependent on imports of crude oil and refined products despite a steadily increasing domestic production.[34] The cost of imports was about $1.85 billion in 1977, $2.0 billion in 1978, and estimated at $3.5 billion in 1979. Iran, Iraq, Saudi Arabia, the U.S.S.R., and the United Arab Emirates were the major crude oil suppliers through 1978. The situation changed in 1979, however, with Iran dropping from first to third place among suppliers. The U.S.S.R. was the largest supplier of refined products.

India's crude import requirements for 1980 were projected to rise to 18 million tons, but will be affected by any measures adopted to curtail demand. Most of these imports were expected to be met by traditional suppliers but in addition the Government contacted Nigeria, Algeria, Indonesia, and several Latin American countries in an effort to diversify its crude oil sources and to secure long-term commitments for these supplies.

Total refined product imports for 1980 were projected at around 5.0 million tons. India's total import bill for both crude oil and refined products could rise to about $4.6 billion or roughly 50% of India's total export value.

Consumption of petroleum products increased nearly 9% in 1978, and was estimated to be 11% higher in 1979. The increased consumption was due partly to the drought conditions which lead to expanded use of diesel oil for irrigation pumps. The country's general infrastructure problems also forced greater use of trucks and hence additional motor fuel consumption.

The 11 Indian refineries operated at about 80% of their 31.5-million-ton-per-year rated capacity in 1978. Except for the 0.5-million-ton-per-year Assam Oil Co. refinery at Digboi, which was scheduled to be taken over by the GOI, India's entire refining capacity falls under the public sector control. The Madras and Cochin refineries, however, still have about 26% of their respective shares held by non-Indian interests.

Construction of the 6-million-ton-per-year Mathura refinery in Uttar Pradesh continued but work was delayed nearly a year by labor problems and a slippage in equipment deliveries, primarily from the U.S.S.R.

The main development in 1978 was the completion on schedule of the 76-centimeter subsea crude pipeline from the Bombay High to Uran near Bombay. The parallel natural gasline also began operating and contributed 12% of the total natural gas consumption. The oil pipeline completion allowed a doubling of offshore crude oil production in 1978 to nearly 3 million tons, and a further increase to an estimated 4.4 million tons in 1979. Onshore production dropped slightly in 1978 and probably was static in 1979.

Development work on Bombay High continued at a high rate. Six platforms have been installed, two of which also have separation facilities. A compression and pumping station for Bombay High north platform is to be installed by May 1980 with a processing capability of 180,000 barrels per day of oil and 106 million cubic feet per day of gas. Work on other platforms was underway which would raise production to 140,000 barrels per day by September 1980. At Uran, the receiving end of the Bombay High pipeline, construction was underway on oil storage tanks, a crude stabilization plant, and gas fractionation units. The Uran complex, scheduled for mid-1980 completion was designed to handle up to 240,000 barrels per day of crude and 212 million cubic feet per day of gas with provision for further expansion.

Development of the 10-trillion-cubic-foot Bassein offshore gasfield was expected to be started in 1980. Gas from this field will be used initially for fertilizer production in Maharashtra and Gujarat.

Coal.—Coal was India's principal commercial energy resource, and the Government continued to stress the importance of exploration and periodic reassessment of national coal reserves. According to the latest estimates, Indian coal reserves were increased from 84 billion tons in 1973 to nearly 112 billion tons in 1979 with 26 billion tons now counted proved. These total deposits were calculated to a depth of 1,200 meters and seams in excess of 0.5 meter thick. Lignite reserves were 3.5 billion tons and 58% classed as proved.[35] A major deposit not included in the reserves was discovered under the Gujarat oilfields at a depth of 1,200 to 2,000 meters.

Despite the impressive reserve figures, most Indian coal contains a very high ash content, high moisture, and low calorific value causing at times severe utilization problems.

Coal production has remained nearly static for the last 4 years and fell well below the projected demand of 116 million tons in FY1979-80. Coal production was valued at $916 million in FY1978-79 and about $1,360 million in 1979-80. About 13 million tons of coal demand could not be met in 1979, although pithead stocks remained at about the 1978 level of 14 million tons.

India's coal industry faced a number of problems in addition to the power situation already described. Among them were a surplus labor force and a high rate of absenteeism and labor problems which affected cost and productivity (approximately 0.67 ton per worker shift for the last 5 years). Coal India Ltd. (CIL), the Government-owned holding company for the coal industry, and the few captive mines of the steel mills, employed more than 600,000 people, over half of the total mineral industry labor force. The surplus labor force totaled about 50,000.

A shortage of certain explosives accounted for a production loss of over 500,000 tons in 1979. Imports of explosives amounted to 3,800 tons but fell short of the requirements by 3,200 tons. Flooding caused a 2.5-million-ton production loss in 1978 but was not an important factor during 1979.

Coal transport bottlenecks affected the movement of coal from the pithead to the consumer. The average daily supply of railroad cars reportedly was 8,400 compared to a demand of 9,600. For CIL, average daily loading dropped 5% in 1979 and rail car turn around time increased from 11 days in 1976 to 14 days in 1979.

To meet the growing demands of the steel mills for improved and consistent grades of coal, six new coking coal washeries plus one major expansion were under construction at a total cost of $400 million. Completion of these will raise the annual washery throughput capacity for coking coal 11.3 million tons per year to 34.9 million tons per year. In addition, the first two noncoking coal washeries totaling 7.5 million tons per year capacity are to be built. Scheduled for FY1984-85 completion, these two plants will be located at the Singrauli coalfield.

The National Thermal Power Corp. was considering establishing captive washeries at each of four planned super thermal power stations which will require 37 million tons per year of coal to operate. Capacity utilization of the current operating washeries was 69% in 1978-79.

The ash content of the coal now being washed ranges from 24% to 37%. Washing reduces the ash to a range of 18% to 20%. One hundred tons of raw coal yields 55 to 65 tons of washed coal; 20 to 25 tons of middlings containing 34% to 40% ash, and the balance is waste. Middlings are generally sold as noncoking coal for power generation.

Capital expenditures during 1980-84 by CIL are estimated at $3.12 billion. Major coal development projects place emphasis on short gestation open pit mines and reconstruction and mechanization of underground mines. By the end of the decade, 50% of production should be coming from open pit mines compared with 25% in 1978.

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[1] Physical scientist, Branch of Foreign Data.

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The Mineral Industry of Indonesia

By John C. Wu[1]

Indonesia's gross domestic product (GDP) in current prices was $51,200 million in 1979 compared with $50,297 million in 1978.[2] Between 1977-79, the annual growth rate of the GDP at constant 1973 prices averaged 6.6%. In 1978, the three largest components of the GDP were agriculture, $17,151 million; wholesale and retail trade, $8,349 million; manufacturing, $6,187 million; and mining and quarrying, $5,583 million.[3] For the past decade, annual input by the mining and quarrying sector constituted close to 12% of the GDP.

Under the Third 5-Year Development Plan (1979-1984), Indonesia's real economic growth was projected at 6.5% per year. Rural development, transmigration programs, regulations of land ownership, and expanded education and health programs were to be stressed to achieve social equity. The industrial sector, to be the fastest growing sector, was to provide increasing employment opportunities. Also, the Government was to encourage the private sector to increase its share in capital investment programs. Private foreign investment would continue under the plan to be a source of capital, technology, and management skills. The projected average annual growth rate by sector during the 5 years was as follows: Industry, 11.0%; transportation and communications, 10.0%; construction, 9.0%; mining, 4.0%; agriculture, 3.5%; and other components, 8.1%. Growth targets were scaled back to slightly below the levels in the previous development plan because of an expected stagnation or decline in oil production.

The fuels sector, presently accounting for two-thirds of total export earnings and for about one-half of government revenues, will continue to dominate the economy. While Indonesia's daily output has declined from a peak output of 1.68 million barrels per day (mbpd) in 1977 to between 1.55 and 1.60 mbpd in 1979, revenues were up as a result of price hikes. Notwithstanding, the Government considered an active oil exploration program to be essential. Significant progress was made in the production of liquefied natural gas (LNG). During 1979, five liquefaction trains were in operation, two in Kalimantan and three in Sumatra. Moreover, prospects for expansions at both fields were good. In coal, the Government continued its effort toward the long-term development of the country's coal reserves. Engineering design contracts were signed for the expansion of the Bukit Asam coal mine. Production sharing contracts were completed with foreign firms for coal concession areas in East Kalimantan. In addition, Indonesia was developing hydroelectric and geothermal energy as a means of preserving petroleum for the export market.

The nonoil minerals sector was the fourth largest foreign exchange earner after oil and natural gas, timber and wood products, and rubber. Indonesia is the fourth largest producer of tin in the world. The growth potential for tin mining is considerable due to large unexplored but likely deposits offshore Sumatra. Freeport Indonesia began work on its expansion of an underground copper mine in Irian Jaya. Pacific Nikkel Co. was reconsidering a nickel venture on Gag Island off the western coast of Irian Jaya. The Government dropped its plans for an alumina complex on Bintan Island; however, work continued on the hydroelectric-aluminum smelter project on the Asahan River, a cooperative venture between Japan and Indonesia.

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The Inter-Government Group on Indonesia (IGGI) is a consortium of 14 donor countries and international financial institutions.[4] IGGI meets annually to consider and to allocate concessionary development loans to Indonesia. In April 1979, IGGI endorsed the Government's new 5-Year Development Plan and agreed that new foreign borrowing by the Government could be increased in 1979 by $2.78 billion. About 70% of the increase (or $1.9 billion) was to be provided by IGGI. Lending configuration of this amount was as follows: Over $1 billion from The World Bank, Asian Development Bank, United Nations Development Program, and bilateral donors; and $850 million from non-IGGI sources, mostly commercial borrowings. Japan was the largest bilateral donor, pledging $262 million, followed by the United States, $205 million.

PRODUCTION

Indonesia's mineral industry is dominated by oil and natural gas production, which are of world consequence. Coal output is insignificant, averaging less than 300,000 tons annually for the past decade. Nickel ore production has increased yearly during the last 5 years, and output in 1979 was nearly double the output in 1975. Indonesia also produces nickel matte and ferronickel. The increased output of tin and copper during 1978-79 was largely offset by sharp decreases in output of iron sands, gold, and silver. Manganese mining has continued to decline since 1975. Indonesia's cement production capacity grew from 2.5 million tons per year in 1977, to 4.8 million tons in 1978, and in 1979 reached 5.9 million tons. The momentum in construction activities was reflected by increased output of cement, aggregates, and other construction materials. Development of the fertilizer industry since 1974 was evident inasmuch as production of nitrogenous fertilizers has increased annually. By the end of 1979, the production capacity for urea and ammonia was 1.6 million tons per year.

Table 1.—Indonesia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum: Bauxite, dry equivalent, gross weight thousand tons	940	1,301	1,008	1,000
Copper, mine output, metal content	69,070	61,600	59,000	57,000
Gold metal[1] troy ounces	[r]114,000	82,300	81,600	70,000
Iron and steel:				
Iron sand, dry basis	292,334	311,519	218,439	203,000
Ferroalloys: Ferronickel	16,886	21,574	19,733	20,000
Crude steel	139,000	145,000	150.000	180,000
Manganese ore	9,833	5,976	5,889	4,500
Nickel:				
Mine output, metal content[2]	[r]28,772	33,083	31,914	35,700
Metal, Ni content of ferronickel and nickel matte	3,857	4,928	4,499	4,200
Silver, mine output, metal content thousand troy ounces	1,072	790	826	850
Tin:				
Mine output, metal content	24,456	25,926	27,437	26,000
Metal	23,322	24,005	25,829	28,000
NONMETALS				
Asbestos[e]	100	60	NA	NA
Cement, hydraulic thousand tons	1,804	2,678	3,040	3,400
Clays:				
Kaolin powder	29,323	36,676	34,114	36,000
Other, for cement manufacture thousand tons	380	NA	NA	NA
Diamond:				
Industrial[e] thousand carats	12	12	12	12
Gem[e] do	3	3	3	3
Total do	15	15	15	15
Iodine kilograms	27,290	20,465	7,253	9,100
Nitrogen, N content of ammonia	184,910	410,463	584,655	900,000
Phosphate rock	7,565	3,149	1,305	1,000
Salt, all types thousand tons	213	563	650	650
Stone:				
Marble square meters	25,944	NA	33,495	30,000
Limestone[3] thousand tons	2,121	NA	3,256	[e]2,674

See footnotes at end of table.

Table 1.—Indonesia: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Stone —Continued				
Granite thousand tons	804	669	NA	[4]608
Quartz	165,219	269,310	303,572	[4]117,828
Sulfur, elemental[5]	3,483	[e]2,000	[e]2,000	2,000
MINERAL FUELS AND RELATED MATERIALS				
Asphalt rock, bitumen content	104,990	137,701	161,800	160,000
Carbon black	1,715	974	NA	NA
Coal thousand tons	183	231	264	[4]279
Gas, natural:				
Gross million cubic feet	312,368	533,355	643,148	[4]998,457
Marketed do	126,426	199,951	384,116	[4]398,807
Natural gas liquids: Propane and butane[e] thousand 42-gallon barrels	70	70	11	15
Petroleum:				
Crude, including field condensate do	550,319	615,123	596,698	[4]601,236
Refinery products:				
Gasoline do	9,763	14,444	15,363	[4]21,934
Jet fuel do	589	663	650	[4]2,464
Kerosine do	13,818	19,887	19,187	[4]34,961
Distillate fuel oil do	15,215	19,445	36,691	[4]33,897
Residual fuel oil do	8,036	15,185	42,440	[4]54,718
Lubricants do	14	24	6	[4]544
Other:				
Liquefied petroleum gas do	291	299	524	[4]463
Paraffin wax do	267	328	300	[4]338
Naphtha do	1,835	100	NA	[4]655
Unfinished oils requiring further processing do	29,961	37,403	NA	[4]1,463
Unspecified do	1,145	--	3,946	[4]4,015
Refinery fuel and losses do	2,411	5,503	2,887	[4]4,056
Total do	83,345	113,281	121,994	[4]159,508

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] Includes Au content of copper ore and output by Government-controlled operations. Gold output by operators of so-called People's mines is not available but may be as much as 30,000 troy ounces per year.

[2] Includes a small amount of cobalt which is not recovered separately.

[3] Data represent limestone used for cement production. Excludes considerable amounts of limestone produced by enterprises under local jurisdictions for building materials, for crushed rock to be used as aggregate, and to burn for lime.

[4] Reported figure.

[5] Sulfur produced by other than the Frasch process.

TRADE

As a result of oil exports, Indonesia's strong balance-of-payment position improved favorably at the end of the decade. Total exports grew from $10,853 million in 1977 to $11,643 million in 1978, reaching $15,578 million in 1979. Imports grew less sharply from $6,230 million in 1977, to $6,690 million in 1978, to $7,225 million in 1979.

As in the past, the largest share of Indonesia's trade has been with other countries in Asia. In 1978, trade with Far East nations accounted for 69% of Indonesia's total trade, compared with 77% in 1979. Exports to Japan alone in 1978 were valued at $4,566 million, and in 1979, $6,501 million. Imports from Japan were $2,016 million in 1978 and $1,906 million in 1979. The United States was Indonesia's second most important trading partner. Exports to the United States were $2,962 million in 1978 and $2,858 million in 1979 compared with Indonesian imports from the United States of $832 million and $933 million, respectively. Imports from Europe were $993 million in 1979, whereas exports totaled $1,036 million.

By commodity group, Indonesia's leading export classes in 1979 were, in million dollars: Mineral products, 9,283; wood and articles thereof, 1,623; resins and rubber, 857; vegetable products, 853; base metals, 455. The top five import classes in 1979 were, in million dollars: Machinery and electrical equipment, 1,501; base metal manufactures, 852; vegetable food products, 755; minerals, 745; and chemicals, 739.

Mineral shipments continued to be of overriding importance in terms of total exports. In 1979, mineral exports (including oil) constituted 66% of total exports. The

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value of oil exports alone was $8,858 million compared with exports of tin and other minerals of $424 million. Indonesia ships significant quantities of bauxite, copper concentrate, and nickel ore and concentrate, primarily to Japan.

Table 2.—Indonesia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite and concentrate thousand tons	1,138	911	Japan 882; Netherlands 29.
Metal including alloys, all forms	174	77	Mainly to Singapore.
Copper ore and concentrate	182,292	186,601	Japan 138,171; Federal Republic of Germany 48,430.
Iron and steel metal:			
Scrap	--	6,018	Philippines 5,668; Japan 350.
Ferroalloys	3,800	4,686	Japan 4,392; United States 294.
Steel, primary forms	9	--	
Semimanufactures	49	7,721	Hong Kong 4,005; Singapore 3,327.
Manganese ore and concentrate	260,044	88,528	Japan 87,868; Taiwan 650; Singapore 10.
Nickel:			
Ore and concentrate	640,630	576,377	All to Japan.
Matte, speiss, similar materials	2,830	15,627	Japan 12,856; Netherlands 2,771.
Tin:			
Ore and concentrate	1,968	976	All to Malaysia.
Metal including alloys:			
Scrap	2,695	676	All to Japan.
Unwrought	21,314	22,859	Japan 6,670; Netherlands 6,300; Singapore 5,089.
Semimanufactures	2,207	([1])	All to Singapore.
Zinc:			
Oxide	185	80	All to Japan.
Metal including alloys:			
Scrap	378	115	Singapore 100; Japan 15.
Unwrought and semimanufactures	93	253	Singapore 211; Japan 42.
Other: Ash and residue containing nonferrous metals	111	567	Taiwan 250; Singapore 195; Republic of Korea 104.
NONMETALS			
Abrasives: Pumice, emery, natural corundum, etc	5	23	All to Singapore.
Barite and witherite	3,402	12,546	Singapore 7,353; Saudi Arabia 4,082; Kuwait 1,110.
Bromine, iodine, fluorine	17	--	
Cement	--	36,700	All to Thailand.
Clays, crude:			
Bentonite	([1])	2,736	Taiwan 2,000; Singapore 736.
Kaolin	2,175	2,558	Taiwan 1,928; Japan 610; Federal Republic of Germany 20.
Other	--	49	All to Singapore.
Fertilizer materials:			
Manufactured, nitrogenous	310,577	243,952	India 102,675; Zambia 52,599; Philippines 41,961.
Ammonia	1,366	827	Malaysia 493; Singapore 293; Thailand 41.
Stone, sand and gravel:			
Crude and partly worked	187,031	260,750	All to Singapore.
Worked	3	6	All to France.
Quartz and quartzite	937	--	
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	2,969	--	
Coal, all grades, including briquets	15,350	31,673	Malaysia 11,450; Singapore 9,150; Thailand 6,773.
Coke and semicoke	1,000	--	
Gas, hydrocarbon, natural thousand tons	359	5,012	Japan 3,663; United States 1,282; New Zealand 30.
Petroleum:			
Crude thousand 42-gallon barrels	506,638	518,022	Japan 218,359; United States 163,911; Singapore 44,672.
Refinery products:			
Gasoline, motor do	1,073	101	All to Sabang.[2]
Kerosine and white spirit do	33,825	329	Japan 213; Sabang[2] 115.
Distillate fuel oil do	428	1,563	Thailand 1,012; Sabang[2] 192; Hong Kong 184.
Residual fuel oil do	1,596	29,765	Japan 24,099; United States 5,666.
Mineral jelly and wax do	204	205	Singapore 177; Philippines 28.
Total do	37,126	31,963	

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[1] Less than 1/2 unit.

[2] Official Indonesian trade statistics report exports to Sabang, an Indonesian island near the western end of Sumatra which operates as a free trade zone; final destination of such shipments can not be determined.

Table 3.—Indonesia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate	300	320	Singapore 300; China, mainland, 20.
Oxide and hydroxide	17,664	21,866	Japan 10,164; United States 6,007; United Kingdom 2,462.
Metal including alloys:			
Scrap	1	42	Singapore 30; Japan 10; United Kingdom 2.
Unwrought	11,623	12,288	Japan 6,193; Canada 2,192; Australia 2,007.
Semimanufactures	17,205	18,363	Japan 6,971; Romania 1,663; United States 1,543.
Arsenic trioxide, pentoxide, acide	91	142	Malaysia 69; France 33; Federal Republic of Germany 16.
Chromium:			
Ore and concentrate	(1)	41	All from Japan.
Metal including alloys, all forms	87	220	U.S.S.R. 95; Italy 60; China, mainland, 40.
Cobalt oxide and hydroxide	15	9	Australia 5; Belgium-Luxembourg 3; United Kingdom 1.
Copper:			
Matte	3	--	
Copper sulfate	172	100	France 40; Japan 22; Netherlands 10; United Kingdom 10.
Metal including alloys, all forms	14,811	18,240	Japan 14,977; Australia 2,049; Federal Republic of Germany 492.
Gold metal, unworked or partly worked troy ounces	329,545	183,902	United Kingdom 89,057; Federal Republic of Germany 87,289; Switzerland 7,555.
Iron and steel:			
Ore and concentrate	209	55,070	Sweden 55,020; Malaysia 50.
Metal:			
Scrap	47,084	80,690	Australia 33,400; United States 20,981; Singapore 8,213.
Pig iron, including cast iron	34,411	32,429	India 12,838; Turkey 10,000; Republic of Korea 3,000.
Sponge iron, powder, shot	558	260	United Kingdom 53; Federal Republic of Germany 46; Japan 41.
Spiegeleisen	--	40	All from Federal Republic of Germany.
Ferroalloys	2,632	4,172	Taiwan 1,662; Australia 1,054; Philippines 605.
Steel, primary forms	167,812	203,456	Taiwan 66,960; Australia 39,644; India 34,532.
Semimanufactures:			
Bars, rods, angles, shapes, sections	273,433	240,498	Japan 152,577; Australia 45,430; Taiwan 16,904.
Universals, plates, sheets	581,002	662,731	Japan 529,113; Republic of Korea 44,596; Australia 25,487.
Hoop and strip	43,955	37,821	Japan 33,858; Taiwan 1,591; Australia 1,319.
Rails and accessories	9,890	16,200	Japan 9,547; Netherlands 2,506; United Kingdom 920.
Wire	5,969	5,980	Japan 3,278; Australia 957; Federal Republic of Germany 380.
Tubes, pipes, fittings	92,942	185,873	Japan 121,974; Singapore 30,920; France 9,584.
Castings and forgings, rough	5,056	5,192	Japan 1,406; India 744; Australia 694.
Lead:			
Oxides	710	1,125	Australia 825; China, mainland, 135; United Kingdom 50.
Metal including alloys, all forms	4,883	7,243	Australia 6,374; Federal Republic of Germany 573; North Korea 102.
Magnesium metal including alloys, all forms	85	21	Australia 6; Japan 6; Belgium-Luxembourg 5.
Manganese:			
Ore and concentrate	7,940	8,605	Singapore 5,684; Republic of South Africa 500; Philippines 400.
Oxides	2,710	4,067	Singapore 2,350; Japan 1,590; Hong Kong 105.
Mercury	289	653	Singapore 465; Japan 100; Federal Republic of Germany 71.
Molybdenum metal including alloys, all forms	5	3	Japan 2.
Nickel:			
Ore and concentrate	1	(1)	All from United States.
Metal including alloys, all forms	252	1,669	Federal Republic of Germany 1,291; Japan 269.
Platinum-group metals including alloys, all forms troy ounces	161	3	All from Japan.
Silver metal including alloys, all forms do	104,554	16,398	Australia 15,432; United States 210.
Tin metal including alloys, all forms	50	220	Federal Republic of Germany 98; Singapore 52; Japan 19.
Titanium oxides	5,483	7,603	Japan 2,942; Federal Republic of Germany 2,304; Australia 1,406.

See footnotes at end of table.

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Table 3.—Indonesia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Tungsten metal including alloys, all forms	1	12	Japan 10; Hungary 1.
Uranium and thorium oxides, including rare-earth oxides	111	165	France 123; China, mainland, 40.
Zinc:			
Oxide	1,009	248	Federal Republic of Germany 108; Japan 85; Singapore 21.
Metal including alloys:			
Scrap	166	--	
Blue powder	56	50	Australia 20; Singapore 18; United Kingdom 10.
Unwrought	36,645	44,617	Australia 35,625; Japan 5,567; Canada 1,855.
Semimanufactures	1,397	1,146	Japan 890; Singapore 143; Australia 23.
Other:			
Ores and concentrates	150	258	Mainly from Australia.
Oxides, hydroxides, peroxides of metals	257	273	Japan 119; Singapore 64; Federal Republic of Germany 34.
Metals including alloys, all forms:			
Metalloids: Phosphorus	68	64	Federal Republic of Germany 49; Japan 15.
Alkali, alkaline-earth, rare-earth metals	3	16	Hong Kong 5; Taiwan 5; Belgium-Luxembourg 2.
Pyrophoric alloys	33	47	China, mainland 28; Taiwan 3; Austria 16.
Base metals including alloys, all forms, n.e.s	467	471	Australia 350; Japan 47; China, mainland, 36.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	604	281	Netherlands 105; Japan 79; Singapore 36.
Dust and powder of precious and semiprecious stones kilograms	264	--	
Grinding and polishing wheels and stones	1,041	1,090	Taiwan 392; Republic of Korea 167; Japan 145.
Asbestos	11,363	14,781	Canada 7,084; Australia 3,075; China, mainland, 2,440.
Barite and witherite	760	22,295	Thailand 20,204; Sabang[2] 708; Malaysia 600.
Boron materials:			
Crude natural borates	88	1	Mainly from Federal Republic of Germany.
Oxide and acid	93	295	United States 197; Federal Republic of Germany 37.
Cement thousand tons	590	420	Philippines 184; Japan 122; Singapore 39.
Chalk	493	638	Federal Republic of Germany 417; Belgium-Luxembourg 140.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	8,461	25,313	United States 13,827; Singapore 7,215; India 2,800.
Kaolin	3,500	8,247	Australia 5,715; Malaysia 1,320; United States 533.
Kyanite and sillimanite	18	([1])	All from Netherlands and Federal Republic of Germany.
Other	2,224	7,649	Japan 4,441; United States 954; United Kingdom 774.
Products:			
Refractory (including nonclay brick)	32,223	24,603	Japan 8,836; Federal Republic of Germany 3,514; United States 2,973.
Nonrefractory	2,544	3,723	Japan 1,681; Federal Republic of Germany 639; Italy 549.
Cryolite and chiolite	100	1	All from Australia.
Diamond, industrial carats	--	52,500	Australia 50,000; Singapore 2,500.
Diatomite and other infusorial earth	525	508	United States 275; Japan 83; Republic of Korea 50.
Feldspar, leucite, nepheline	6,014	6,766	China, mainland, 4,030; India 1,151; Italy 900.
Fertilizer materials:			
Crude:			
Nitrogenous	33	300	China, mainland 240; Taiwan 60.
Phosphatic	103	3	Mainly from Federal Republic of Germany.
Potassic	5	201	Federal Republic of Germany 101; Netherlands 100.
Other	1,357	1,039	Belgium-Luxembourg 1,025; Netherlands 8; United States 4.
Manufactured:			
Nitrogenous	28,283	43,833	United States 11,000; Republic of Korea 10,000; Federal Republic of Germany 8,834.

See footnotes at end of table.

Table 3.—Indonesia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Fertilizer materials —Continued			
Manufactured —Continued			
Phosphatic	118,931	278,039	United States 154,625; Federal Republic of Germany 45,639.
Potassic	37,973	107,667	Federal Republic of Germany 64,187; Canada 13,599; U.S.S.R. 12,700.
Other, including mixed	6,522	21,243	Federal Republic of Germany 11,579; Netherlands 3,627.
Ammonia	280	319	Singapore 275; Japan 12; United States 12.
Graphite, natural	206	170	Japan 54; Republic of Korea 50; Federal Republic of Germany 22.
Gypsum and plasters	109,653	157,757	Japan 92,937; Australia 28,807; Republic of Korea 23,560.
Lime	582	741	Singapore 354; Malaysia 295; Japan 33.
Magnesite	109	440	Japan 415; Netherlands 15; Federal Republic of Germany 10.
Mica, all forms	297	386	India 150; United States 128; Federal Republic of Germany 36.
Pigments, mineral:			
Natural, crude	502	639	China, mainland, 586; Japan 20; Netherlands 15.
Iron oxides, processed	1,480	1,921	Federal Republic of Germany 692; China, mainland, 579; Japan 418.
Precious and semiprecious stones, except diamond, manufactured value	$158	$470	All from Singapore.
Pyrite, gross weight	--	11	All from Australia.
Salt and brine	2,327	2,735	Thailand 618; Federal Republic of Germany 585; India 521.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	48,550	28,244	Romania 11,230; United States 6,777; Federal Republic of Germany 3,612.
Caustic potash and sodic and potassic peroxides	642	900	Japan 248; Federal Republic of Germany 178; Israel 150.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	140	675	Republic of Korea 200; India 125; Japan 123; Italy 115.
Worked	1,525	3,653	China, mainland, 3,075; Japan 273; Italy 211.
Dolomite, chiefly refractory grade	1,768	1,342	Taiwan 1,050; Thailand 119; Japan 106.
Gravel and crushed rock, n.e.s	311	920	Malaysia 268; France 254; China, mainland, 165.
Limestone, except dimension	131	431	All from Japan.
Quartz and quartzite	107	339	Japan 100; United States 95; China, mainland, 50.
Sand, excluding metal bearing	943	1,860	United States 364; Taiwan 350; Federal Republic of Germany 347.
Sulfur:			
Elemental:			
Other than colloidal	2,132	1,335	Taiwan 725; Singapore 420; Federal Republic of Germany 149.
Colloidal	28,273	45,748	Canada 38,176; Singapore 6,232; Taiwan 898.
Sulfur dioxide	13	31	China, mainland, 25; Federal Republic of Germany 4; Singapore 1.
Sulfuric acid, including oleum	1,470	4,382	Singapore 3,709; Thailand 350; Federal Republic of Germany 192.
Talc, steatite, soapstone, pyrophyllite	12,835	11,159	China: mainland 7,995; Taiwan 1,236; Republic of Korea 1,283.
Other:			
Crude:			
Meerschaum, amber, jet	51	40	All from Federal Republic of Germany.
Strontium and other minerals	335	379	Thailand 200; Japan 146; Singapore 25.
Slag, dross, and similar waste, not metal bearing	349	5,944	Japan 5,300; Singapore 230; Kenya 115.
Oxides and hydroxides of magnesium, strontium, barium	1,122	1,749	Japan 1,401; Singapore 210; Federal Republic of Germany 57.
Bromine, iodine, fluorine	12	16	Taiwan 7; United Kingdom 6; United States 2.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	3,394	3,554	France 1,746; Singapore 924; Japan 464.

See footnotes at end of table.

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Table 3.—Indonesia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	52,182	39,713	Singapore 33,914; Taiwan 5,201; Japan 168.
Carbon black and gas carbon:			
Carbon black	13,549	17,649	Australia 13,189; Japan 2,966; Malaysia 559.
Gas carbon	1	1	Mainly from United States.
Coal, all grades, including briquets	74	2,517	Republic of Korea 2,500; Japan 10; Singapore 5.
Coke and semicoke	16,025	17,729	Taiwan 6,916; Federal Republic of Germany 6,259; Australia 1,963.
Hydrogen and rare gases	7	20	Australia 8; Netherlands 6; Japan 3.
Petroleum:			
Crude thousand 42-gallon barrels	21,586	14,638	All from Saudi Arabia.
Partly refined do	2,956	1,779	Singapore 1,431; United States 196; Australia 103.
Refinery products:			
Gasoline, motor do	2,176	1,413	Mainly from Singapore.
Kerosine and white spirit do	10,636	5,875	Singapore 5,668; Japan 75; U.S.S.R. 75.
Distillate fuel oil do	2,743	2,767	Singapore 2,741; Republic of Korea 26
Residual fuel oil do	3,549	1,596	Mainly from Singapore.
Lubricants, including grease do	393	2,537	Japan 1,088; United States 260; Federal Republic of Germany 249.
Other:			
Liquefied petroleum gas do	11	6	United States 5; Singapore 1.
Mineral jelly and wax do	19	21	Federal Republic of Germany 8; United States 4; Netherlands 3.
Nonlubricating oils, n.e.s. do	202	119	Singapore 33; China, mainland, 30; Australia 28.
Bitumen and other residues do	1,083	758	Singapore 665; Taiwan 81.
Bituminous mixtures, n.e.s do	10	26	Singapore 12; Taiwan 6; United Kingdom 3.
Pitch, pitch coke, petroleum coke do	38	15	Singapore 10; Taiwan 5.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,730	1,760	United Kingdom 575; Australia 359; Federal Republic of Germany 356.

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[1] Less than 1/2 unit.

[2] Official Indonesian trade statistics report imports from Sabang, an Indonesian island near the western end of Sumatra which operates as a free trade zone; actual origin of such shipments can not be determined.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—The existing bauxite mines, operated by a unit of the State-owned P.T. Aneka Tambang, produced a little more than 1 million tons of high-grade bauxite (up to 53% Al_2O_3 content and 10% moisture) in 1978 and 1979. These mines are located around Kijang on Bintan Island and the nearby islets of Kijan, Angkut, Dendang, Kelong, and Tembeling. Practically all of the bauxite is exported to Japan under a 10-year contract calling for 1.2 million tons per year. The contract will expire in 1984, when the entire 8 to 9 million tons of export-grade bauxite reserves are expected to be virtually depleted.[5] The reduction in production and export of bauxite in recent years is primarily due to lack of demand for bauxite in Japan, where about one-third of the aluminum reduction plants have been closed for various economic reasons.[6]

During 1978, two major events had been reported on Indonesia's alumina and aluminum development projects. The first significant event was related to the alumina project, which calls for the building of a new alumina smelter on Bintan Island. The second event was related to the Asahan aluminum project, which calls for the building of two hydroelectric powerplants, a 225,000-ton-per-year aluminum smelter, and extensive ancilliary facilities located on the Strait of Malacca at Kuala Tanjung, Sumatra.

The Government of Indonesia, through P.T. Aneka Tambang, has been considering proposals from several countries since 1971 to build a new alumina smelter on Bintan which would convert the estimated 25 to 27.5 million tons of reserves of below-export-grade Bintan bauxite into alumina. It would supply 450,000 tons of feedstock annually for the Asahan aluminum smelter at Kuala Tanjung in North Sumatra, scheduled to start its first-stage operation in 1982. One of these proposals was a $590 million (estimated at $450 million in 1977), 600,000-ton-per-year alumina smelter on Bintan Island submitted by the German company Klockner I.N.I. and the Aluminum Co. of America (ALCOA). This proposal was accepted by the Indonesian Government in December 1978. Then by a surprising move of the Indonesian Government, the whole project was cancelled in January 1979. The main reason for dropping the tender was that Japanese suppliers estimated that they could supply alumina at $180 per ton in 1982, whereas the proposed Bintan alumina would cost about $225 per ton. However, P.T. Aneka Tambang is currently studying the possibility of transporting below-export-grade bauxite from Bintan Island to a proposed alumina smelter at Kuala Tanjung in Sumatra near the site of Asahan aluminum project. The still unanswered question is the suitability of Bintan bauxite for the Asahan aluminum project in terms of its quality and the possibility of cost reduction.

The much publicized Asahan aluminum project, operated by Indonesian Asahan Aluminium, has finally resolved the problem of a substantial cost overrun due to inflation and various design changes of original hydroelectric powerplants in late 1978. The estimated total project cost is now about $2.3 billion, which is more than 2 1/2 times the original $812 million estimated in 1975. The entire project, P.T. Indonesia Asahan Aluminium, is 90% owned by the Nippon Asahan Aluminium Company of Japan (in turn owned by Sumitomo Chemical Industries, Ltd., Showa Denko K.K., Mitsui Aluminium Co., and Mitsubishi Chemical Industries, Ltd.), and 10% by the Government of Indonesia. The Government will boost its equity stake in the venture to 25% within the next 2 years.[7] The physical construction of the aluminum smelter began on June 8, 1978, at Kuala Tanjung on the Malacca Strait, North Sumatra, and construction of the first gigantic Asahan hydroelectric powerplant started near the Sigura-gura Pintupohan waterfall in North Tapanuli the next day.[8] The Asahan Project's aluminum smelter is proceeding on schedule. The first-stage operational goal is to produce 75,000 tons of aluminum ingots per year when the plant goes into production in 1982. It is to produce 150,000 tons per year in 1983, and upon completion of all facilities in 1984 the smelter would have an annual capacity of 225,000 tons. The Asahan hydroelectric power complex is also proceeding on schedule. It involves three separate projects on the Asahan River: the regulating dam, 16 kilometers downstream from Lake Toba; the Sigura-gura intake dam and the first power station with installed capacity of 286 megawatts, a further 8 kilometers downstream; and Tangga intake dam and the second power station with installed capacity of 317 megawatts, 6 kilometers downriver from Sigura-gura. A 120-kilometer transmission line with 275-kilovolt capacity to carry electricity from power stations to the smelter at Kuala Tanjung will be built. The whole Asahan project also calls for development of a new port at Kuala Tanjung, now being constructed with a 2.5-kilometer-long pier to connect one temporary and three permanent berths to the mainland. These will be for shipping alumina and aluminum ingot from the smelter. When the Asahan aluminum project is completed, the smelter will employ about 2,100 workers and the powerplants about 100 people.[9] It is still unknown as to whether the Asahan smelter would use the Bintan bauxite, which is currently under study for its suitability; otherwise, the Asahan smelter would be likely to use imported alumina from the world market as feedstock in 1982.

P.T. Alco Minerals of Indonesia (ALCOMIN), a subsidiary of ALCOA, had planned to build a 1.6-million-ton mining and an alumina refinery in the Kapuas area of West Kalimantan. The facilities would use an extensive recoverable bauxite reserve discovered recently amounting to 810 million tons along the Kapuas River in the Tayan area. However, the plan appears to have been completely abandoned in view of the high capital costs and adverse conditions in the world markets.[10]

Chromite.—A formal agreement was signed between Indonesia's P.T. Perto and three Japanese firms on a $1 million, 2-year chrome mining exploration project in January 1978. The joint venture, 60% owned by

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the Indonesian firm and 40% by the Japanese Sulawesi Chrome Development, Ltd. (Kanematsu Gosho Ltd., Kawatessu Trading Co., and Chugain Mining Co.), is currently investigating a 200-square-kilometer area, about 110 miles north of Pare-pare in Sulawesi.

AMAX, Inc., of the United States and the Japanese Kawasaki Steel Corp., a leading stainless steel producer in the world, were also interested in mining chromium in Indonesia for export to Japan. AMAX is interested in black sands containing chromite particles on concession areas held by Indonesian firms in Sulawesi and Halmahera. Kawasaki will reportedly provide $3 million for a 2-year southeast Asia survey, using its own mining expertise, while AMAX will transfer to Kawasaki Steel Corp. 50% of its rights to 10 chromium ore mining concessions in Indonesia and several other southeast Asian countries.[11]

Copper.—P.T. Freeport Indonesia, Inc., (80% owned by Freeport Minerals Co. of the United States 8.5% by the Indonesian Government, and 11.5% jointly by Nordeutsche Raffinerie of Germany and South Pacific Copper of the Netherlands), is currently the only active primary copper producer in Indonesia. The firm operates its open-pit mine and concentrator (annual capacity, 225,000 tons of copper concentrate) at Gunung Bijih (Ertsberg), Tembagapura in the high mountains of Irian Jaya. The average copper content of the ore was 2.3% and after concentrating, 32.6% in 1978. The capacity utilization of the concentrator has remained at the 80% to 85% level since it reached its peak at 99.2% in 1975.

Exploration work of the Ertsberg East orebody, 2 kilometers east of the existing Gunung Bijih open-pit mine, has been concluded. Ore reserves were reported at approximately 45 million tons, averaging 2.75% copper content plus important gold and silver values. Bechtel has been conducting the engineering feasibility study since 1978. The mining plans are being based on subsurface block caving with a designed mine capacity of 9,500 tons per day by 1982. Estimated cost of the project is $100 million, construction has started in 1979, and the target date for startup of the first phase is mid-1981 with an output level at 4,500 to 6,000 tons per day.

In light of the revival of the export market in 1979, the Indonesian Government agreed to Freeport's plans to open the Ertsberg East underground block-caving operation. The expansion program of Freeport is apparently moving ahead satisfactorily in a very difficult mountainous region of Northeast Irian Jaya. The new prospect will augment production of the existing open-pit mine, which is expected to be depleted by 1983-84.[12]

Exploration work by P.T. Aneka Tambang at the Gn. Limbung deposit near Bogor, West Java, reportedly discovered more than 500,000 tons of ore containing copper, lead, and zinc. At Sangkaropi, South Sulawesi, about 3 million tons of copper ore and associated minerals have been proved through drilling by P.T. Aneka Tambang. Other drilling is still proceeding at Rumangga, northeast of Sangkaropi, by the same firm to find additional copper reserves.[13]

P.T. Tropic Endeavor, a joint venture between P.T. Aneka Tambang and Endeavor Oil Co. (Australia) and N.L. Kennecott Copper Exploration, Ltd. (Australia),[14] reported prospective copper findings at their 282,000-hectare site, block II working area, in North Sulawesi.[15]

The Government of Indonesia signed a contract in 1978 with P.T. Copperindo Utama, (a joint venture between V. Disco Raya Jaya, the Taiwan Metal Mining Corp., and a Mr. Won Yih Yiin), for a concession area covering 2,500 hectares in the Tasikmalaya regency of West Java.

A cooperative agreement between Indonesia and France, for a geological survey in preparation for the mapping and identification of copper and associated mineral deposits in a 48,000-square-kilometer area in Northeast Kalimantan, was signed in February 1979.

Gold and Silver.—The only official statistics on Indonesian gold and silver production is from the Cikotok mine operation on a 5,200-hectare concession in southern Banten, West Java, owned and operated by P.T. Aneka Tambang. The Cikotok mine produced its gold and silver mainly from its Cirotan and Cimari deposits. Gold and silver production dropped substantially in 1978 and again in 1979. The declining trend of gold and silver production over the last several years is simply a reflection of the declining grade of the ore body. However, the high prices of gold and silver have helped the company to maintain a healthy financial condition. In 1979 new processing equipment has been installed and the precious metals smelting and refining plants have been moved from Pasir Gombong to

Pulo Gadung near Jakarta. It is expected that the production levels will rise in the coming years. An unrecorded amount of gold is also produced by the local population in South Kalimantan and Bengkulen using primitive methods. Indonesia has been importing a substantial amount of its domestic requirements for gold for many years.

Freeport Copper at its operation in Irian Java reportedly had shipments of 58,000 ounces of gold and 745,000 ounces of silver in its copper concentrates in 1978.[16]

P.T. Kariskan and Co., a new private mining company, is reportedly starting serious exploration work for gold in the Province of Gunung Mas in Central Kalimantan.

Iron and Steel.—For the past several years, most of the iron sands produced by P.T. Aneka Tambang from the Cilacap mine, and from a new Palabuhanratu beach deposit on the south coast of Java have been exported to Japan. A halt in exports to Japan in June 1978 from these mines, because of a dispute over price and quantity, caused the production of iron sand to drop significantly in 1978 and further in 1979. All of the iron sand produced by P.T. Aneka Tambang in 1979 is consumed by the growing domestic cement industry. In the 1978-79 period, P.T. Aneka Tambang had discovered an extensive beach deposit of iron sand on the south coast of Yogyakarta (Yogya deposit) amounting to 230 million tons of iron ore capable of yielding approximately 28.5 million tons of 59% iron-sand concentrate. An additional 57 million tons of 59% iron-sand concentrate has been found in the area south of Purworejo in Central Java, about 15 kilometers west of the Yogya deposit.[17]

P.T. Karakatau Steel, a State-owned corporation, completed construction at Cilegon, West Java, of the first phase of its steel mill project, and commenced production in October 1979. The steel mill is located in the northwest corner of Java, approximately 130 kilometers west of Jakarta on the Sunda Strait. The plant is the world's largest Hyl direct reduction plant and also is the first steel complex in Southeast Asia which combines reduction, electric arc furnaces, and continuous casting processes. The Hyl direct reduction plant has four modules with four fixed bed reactors in each module. At present, high-quality iron ore pellets imported from Brazil and Sweden are used to feed the direct reduction plant.

The billet plant comprises four 65-ton, 30/36 megavolt-ampere electric arc furnaces, two four-strand continuous billet casters, rod and sectional rolling mills, a 2,000-liter-per-second water treatment plant and pumping station; and a "T"-shaped deep water pier capable of handling bulk carries up to 50,000 deadweight tons (DWT). A supporting facility of a 400-megawatt steam powerplant was also completed in 1978.

With completion of phase I in 1979, the initial plant is now capable of producing annually, 1,440,000 tons of direct-reduced iron; 220,000 tons of wire rod; 150,000 tons of concrete reinforcing bars; 85,000 tons of medium structural sections; 44,000 tons of rerolling billets.[18]

The Government of Indonesia has given the go-ahead signal to West German firms, including Siemens, Klockner, and Ferrostahl, to start phase II construction, which includes the construction of a hot-strip mill and a slab plant capable of producing 1,000,000 tons of flat-rolled steel products, principally steel sheet. The West German Government will provide a DM1.5 billion loan also in the form of export credits, for the phase II construction, which should last 45 months.[19]

Nickel.—After years of active explorations during the early 1970's conducted by the State-owned P.T. Aneka Tambang, together with three large international companies, namely, P.T. International Nickel (INCO), Indonesian Nickel Development Co. (INDECO), and P.T. Pacific Nikkel Indonesia (P.T. PNI), it is estimated that Indonesia now has a reserve of 824 million tons of nickel-bearing laterites.[20] Most of the Indonesian lateritic nickel deposits are found in Sulawesi and the island groups from Halmahera to the bird head of Irian-Jaya including Obi, Gebe, Gag, Kawe, Waigeo, Manuran, and the area of Tanah Merah (Cyclops Mountains). Several hundred million tons of laterite nickel ore were also discovered in East Kalimantan.

Since 1978, there have been two nickel mining companies operating in Indonesia. P.T. Aneka Tambang in the Pomalaa and P.T. INCO in the Soroako area, both on the southeastern arm of Sulawesi. P.T. Aneka Tambang's nickel operation in Pomalaa includes a mine using a combination of labor-intensive and semimechanized methods, and a ferronickel smelter with an annual capacity of 20,000 tons.

The initial Gebe Island project to mine the nickel ore and to build a $460 million ferronickel processing plant was dropped by

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INDECO in 1977 due to adverse conditions of world nickel market. Later in 1978, P.T. Aneka Tambang took over the Gebe nickel project and reportedly invested over $2 million for the development of the nickel mine and associated infrastructure.

In April 1979, the director of P.T. Aneka Tambang announced that the firm has exported the first trial shipments of 220,000 tons of unprocessed New Caledonia-type nickel ore from Moluccan on Gebe Island. The firm was expected to export about 800,000 tons of nickel ore annually to Japan beginning in 1979, gradually increasing to 1.4 to 1.5 million tons from Gebe Island after a harbor-and-dock project is completed. A new Gebe smelter complex was reportedly being developed by the firm and INDECO. The target production is expected to be 23,000 to 45,000 tons per year of ferronickel. The Annular Vertical Kiln process developed by Sumitomo Metal Mining Co. was proposed by INDECO for Gebe ores.[21]

P.T. INCO, jointly owned by International Nickel Co. of Canada, Ltd., the Indonesian Government, and six Japanese partners, officially opened its Soroako Phase I operation which includes a large mining and refining facility in South Sulawesi at the end of March 1977. The $850 million Soroako operation is the largest lateritic nickel mining project in the world. Upon completion of Phase II, which involved two additional pyrometallurgical process lines and the construction of a 165-megawatt hydroelectric facility, the total annual capacity was projected to be about 45,000 tons of nickel contained in a sulfide matte.[22] Soroako operation has suffered various mechanical and technical difficulties since it began its operation in late 1977. Most of the difficulties have now been overcome, but the production capacity was still not able to be fully utilized in 1979 (only about 8,600 tons of nickel contained in matte was produced) resulting from the corrosion problem caused by the acidity of the ores. It was determined that an additional $15 million of capital expenditures was required to make process improvements involving installation of better crushing facilities to handle the less acidic ores and crush converter slag, and for modifications to the ore drying facilities. The firm anticipates that upon completion of these process improvements, the annual production capacity will be about 36,000 tons of nickel in a 75% matte, instead of the 45,000 tons as originally projected. Production is scheduled to be about 21,000 tons of nickel in matte for 1980 and about 29,500 tons for 1981, to be exported to Japan.[23]

P.T. Pacific Nickel Indonesia's $1 billion nickel project was still in need of financial backing. It was planned to construct a smelter capable of producing 50,000 tons of nickel metal plus 1,400 tons of cobalt metal per year using the modified Sherritt-Gordon process on remote Gag Island off the western coast of Irian. In light of prospective world market conditions for the coming years, in 1979, the World Bank requested a new feasibility study which would determine whether plans for a 3 1/2-year construction work would be followed.[24] If this Gag Island project successfully materializes during the third 5-Year Plan along with other nickel projects at Soroako and Gebe, Indonesia may well become one of the leading nickel producers in the world.

Tin.—Tin metal mining industry is one of the oldest and the most important industries in Indonesia's hard mineral sector. Indonesia's tin reserves (measured) are estimated at 740,000 to 1 million tons[25] located primarily in the tin islands of Bangka, Belitung (Billiton), Kundur, Singkep, the islets of the Riau-Lingga Group and nearby offshore area, and the Bangkinang area on the mainland of Sumatra.

Indonesia's tin production and exports have increased steadily during 1978-79 as world market prices of tin continued to set record highs. Indonesia tin production hit a new record in 1979 after P.T. Tambang Timah introduced its newest and largest tin dredge, *Bangka II* in 1978. Indonesia's tin exports were valued at $311 million in 1978, up 24% from 1977 at $251 million, and showed another record of 21% increase in 1979 at $376 million.[26]

Indonesia is currently ranked the fourth largest tin producer in the world after Malaysia, Thailand, and Bolivia, and is expected to be the second or the third largest tin producer with its annual production passing the 30,000 ton level in 1980 or 1981.[27]

Indonesian tin mining is primarily carried out by the State-owned tin company, P.T. Tambang Timah and three other joint-venture companies: P.T. Koba Tin (since 1971), P.T. Broken Hill Proprietary Indonesia (since 1971), and P.T. Riau Tin Mining, Ritin (formerly, the Dutch N.V. Billiton Exploratie Maatschappij Indonesia). P.T. Tambang Timah (P.T. Timah), continues to be the single largest producer, contributing about 88% of the country's total tin production. It utilizes dredge and hydraulic mining to exploit alluvial tin deposits inland and dredges offshore of the islands of Bangka, Belitung, Singkep, and at the Bangkinang area of the mainland of Sumatra. The firm has 30 bucket-line dredges (including the new *Bangka II*, but excluding 10 small dismountable dredges) and about 175 hydraulic mines supported by other equipment and facilities. *Bangka II* is the firm's newest 22-cubic-foot dredge with 151 dredging cups, a maximum depth capacity of 150 feet, and capable of mining 4.86 million cubic meters of ore annually. It was introduced in October 1978 and was operating at Air Kantung, Sungai-Liat, and Bangka. In April 1979, P.T. Timah signed a contract with the Dutch Mining and Transport Engineering N.V. of Amsterdam for construction of another dredge called *Belitung I*, which was to be built on Batam Island in Indonesia. The *Belitung I* will have a capacity of producing 1,100 tons of tin ore annually and was to be completed by December 1980 at an estimated capital cost of $25 million (including $2 million for the spare parts). Ancilliary equipment including four tugboats and three barges was to be built at a domestic yard by the U. S. firm P.T. McDermot Indonesia as a subcontractor to the Dutch firm, at a cost of $1.6 million.

P.T. Timah also operates a tin smelter (Peltim) at Mentok on Bangka Island. The smelter has three old West German rotary furnaces and three new conventional reverberatory furnaces with total annual capacity of 33,000 tons of tin metal. P.T. Timah began a $2.5 million smelter expansion project, which was to raise its annual smelter capacity to 41,000 tons by 1980. Capacity utilization has been at an average of 75% for the past several years.

P.T. Koba Tin, a joint venture tin company (75% owned by Kajuara Mining Corp. Pty, Ltd., of Australia and 25% owned by P.T. Tambang Timah) operates both offshore and onshore. The firm has mines at its Nibung property and another property at Lubuk Besar in the Koba District of Bangka Island. Its tin production in 1978 had tripled over that of 1976 and was accounting for approximately 10% of Indonesia's total tin production. At full capacity it expects to produce about 3,000 tons per year of tin concentrates. P.T. Koba's tin is smelted and marketed by P.T. Timah.

P.T. Broken Hill Proprietary Indonesia, the second joint-venture company, a subsidiary of the Broken Hill Proprietary Co., Ltd., of Australia, is concentrating its efforts on rehabilitating a formerly Dutch-owned Kelapa-Kampit underground tin mine on Belitung Island and, in the process, produced about 430 tons of tin concentrates in the 1978-79 period.

P.T. Riau Tin Mining, the third joint venture tin company formed in December 1977, has completed under its former name, Billiton Exploratie Maatschappij Indonesia, N.V., its exploration work around the P. Tujuh islands between Bangka and Singkep. The firm began operation in mid-1979 after its new *Bima*, a sea-going dredge bigger than *Bangka II* arrived. *Bima*, ordered from International Construction, Holland, designed by Mining and Transport Engineering, N.V., of Amsterdam, and built at the Jurong shipyard in Singapore, has a bucket capacity of 30 cubic feet, capable of recovering 1,836 cubic meters per hour of tin ore with 137 buckets at a maximum depth of 150 feet. The *Bima*, the world's largest tin dredge is reportedly having technical problems and delays and may have to be returned to the Jurong shipyard in Singapore for repair.

Indonesia's current tin production primarily relied on the aging 30-dredge fleet of P.T. Timah and its depleting onshore tin deposits. For the past several years, a variety of modern methods of exploration, combined with a modern insight in the geological features of offshore tin deposits had helped Indonesia to discover a great many number of rich tin deposits offshore in the Tempilang area in South Bangka and the Penyusu-Kebiang area in North Bangka. The more recent exploration around offshore areas of Singkep indicates that prospective tin deposits are at 30 to 45 meters below sea level in the areas of Kundur, Laut, Kobil-Laut, and Laut Timun. The proven offshore tin reserves near the Bangka area are now estimated at about 1 million tons. Indonesia, with these vast and rich tin reserves offshore and new additions of large offshore dredges, may well become the world's second largest tin producer by the early 1980's.

Uranium.—The Indonesian Atomic Energy Institute continued exploration in 1978-79 for radioactive minerals in a number of areas in the central part of Kalimantan. On April 14, 1978, two amendments to the initial 1969 agreement between Indonesia and France for cooperation in carrying out uranium exploration in Kalimantan was

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signed. The amendments provide that if uranium deposits are found to be economically exploitable, the "French side shall be invited for negotiations concerning their mining." Exploration was to be ended by 1979. The two radioactive bearing minerals discovered so far are uranite and monazite in the Nanga Pinoh District near Sintang in West Kalimantan Province.

Another cooperative agreement on a geological survey between the Governments of Indonesia and France was signed on February 15, 1979, for a preparation of the mapping and identification of copper, uranium, and other mineral deposits in a 48,000-square-kilometer area in the northeastern Kalimantan. The French institution named to carry out this survey was Geological and Mining Research Development, which has started to conduct a similar survey in Nusatenggara Island between Lombok and Timor in September 1977.[28]

Indonesia ratified the Nuclear Non-Proliferation Treaty in November 1978.[29]

NONMETALS

Cement.—As a result of an active expansion effort, Indonesia has reached a production level which not only met the domestic demand (about 4 million tons) but also had made Indonesia a net exporter of cement when the first 50,000 tons of portland cement was exported to Thailand in October 1978. Total cement exports increased substantially in 1979. It is expected that Indonesia's cement production will reach 7 million tons in 1980 with a surplus of 1.4 million tons available for exports to India, Bangladesh, Sri Lanka, Thailand, and Nigeria.[30] The Indonesian cement industry had a total annual capacity of 5.9 million tons in 1979 and this capacity was to continue to be expanded with strong government support until it reaches 10 million tons by 1985. As of mid-1979, the Indonesian cement industry comprised the following seven State-owned cement companies:[31]

Company	Plant location	Annual capacity (tons)
P.T. Semen Gresik	Gresik, East Java.	1,500,000
P.T. Semen Cibinong	Narogong, West Java.	1,200,000
Indocement (PICE)	Citeureup, West Java.	1,000,000
P.T. Distinct Indonesia Cement Enterprise (DICE)	Citeureup, West Java.	1,000,000
P.T. Semen Nusantara	Cilacap, Central Java.	600,000
P.T. Semen Padang	Indarung, Sumatra.	330,000
P.T. Semen Tonasa	Ujung Pandang, South Sulawesi.	110,000
Total capacity		5,900,000

Several other expansion projects were still underway. P.T. Semen Padang was constructing a new 2,000-ton-per-day dry process plant next to its existing Indarung wet process facility in Western Sumatra. Although the construction was delayed (6-9 months) for technological reasons, at the completion of this new 600,000-ton-per-year-capacity plant, P.T. Semen Padang would have an annual capacity of about 1 million tons.

P.T. Semen Tonasa's new 1,650-ton-per-day dry process plant at Biringere Sulawesi was also scheduled to be completed by 1980. The operation, called "Tonasa II," was to have an annual capacity of 500,000 tons added to the firm's existing capacity of 110,000 to 120,000 tons per year.

P.T. Semen Cibinong had decided to expand its production capability of 1.2 million tons to about 2.1 million tons through a progressive modification program. One of the programs was a complete production line of 3,200-ton-per-day capacity.

P.T. Semen Baturaja was building a turnkey 500,000-ton-per-year dry process suspension preheater plant, scheduled to begin production in 1980. The Japanese firm, Kawasaki Heavy Industries was to set up two grinding plants at Palembang and at Panjang and IHI to build a clinker-producing plant at Baturaja in South Sumatra.

Fertilizer.—With effective use of domestic natural gas and an aggressive expansion program, Indonesia's fertilizer industry made substantial progress during the 1978-79 period.

P.T. Pupuk Sriwijaya (P.T. Pusri), the State-owned fertilizer company, operated ammonia/urea fertilizer plants at Palembang, South Sumatra, utilizing natural gas as feedstock, with combined (Pusri I, II, and III) capacity of 910,000 (537,000 tons of urea and 372,000 tons of ammonia) tons annually. By 1979 P.T. Pusri had completed an additional plant (Pusri IV) with a designed annual capacity of 262,000 tons of urea and 272,000 tons of ammonia. A fertilizer plant's bagging unit at Ujungpandang with a capacity of 100,000 tons per year, was also completed at a cost of $12.3 million. The ASEAN fertilizer complex, with an annual capacity of 262,000 tons of urea and 272,000 tons of ammonia in North Aceh was expected to start construction by the end of 1979. This ASEAN fertilizer project will cost an estimated $313 million, of which Japan will provide $220 million in loans. The remaining $93 million will be provided by Indonesia, 60%; Malaysia, the Philippines, and Thailand, 13% each; and Singapore, 1%. The whole construction was to last 36 months and to be completed by 1983. Contracts for construction and design had yet to be awarded by year end 1979.[32]

P.T. Petrokimia Gresik, the second State-owned fertilizer company, operates one urea plant with an annual capacity of 45,000 tons and a 150,000-ton ammonium sulfate plant near Surabaya in East Java, both using petroleum feedstock. The firm has also started to build a TSP (triple superphosphate), DAP (diammonium phosphate) and NPK (nitrogen, phosphorus, and potassium) plant with an annual capacity of 460,000 tons. The construction of this plant was expected to be completed in 1979.

In 1978, Indonesia became a major supplier of nitrogen fertilizer in Asia. The export of fertilizer, like cement, is subject to the government's control. In 1978, it was reported that Indonesia had started to export a few hundred thousands tons of urea to various countries in Asia includes India, Vietnam, and Zambia in Africa. The export volume was lower in 1979 than in 1978.

Besides the new ASEAN plant at Aceh, which was proceeding more or less on schedule, two more fertilizer plants were being planned and constructed: P.T. Pupuk Kujan near Cikompek on Java, and P.T. Kaltim at Muara Badak in East Kalimantan.

Other Nonmetals.—Indonesia also produces limestone and small amounts of iodine, granite, and kaolin. Kaolin in Indonesia is produced in Bangka, Belitung Island, and North Sulawesi. Most kaolin is for the consumption of the domestic ceramic, paint, and cosmetic industries. Granite is primarily produced by P.T. Karimum, a 50-50 joint venture between P.T. Indophing and the Malaysia Gammon Southeast Asia Sdn. Berhad on Karimun Island. The crushed rock is mainly for the consumption of domestic construction industry.[33] Some material has been exported to neighboring countries for the past several years. Iodine is produced in East Java from iodine-bearing brines by P.T. Kimia Farma at Watudakon near Mojokerto. The production of iodine continued to decline. There was no export in 1978.

MINERAL FUELS

Coal.—An era of development and progress in Indonesia's coal industry finally began in 1979. P.N. Tambang Batubara, the State-owned coal company, suffered a major setback in July 1978 when Shell withdrew from its production contract to expand the capacities of existing mines in Bukit Asam, South Sumatra.[34] Shell cited as the reasons for putting off production the problems of the coal quality related to high moisture content, the presence of sodium in the coal, pollution problems related to the presence of lignite in Shell's reserves, and the depressed market.[35] Shell's initial $1 billion coal mining and power generation project in South Sumatra later was awarded to a Canadian consortium comprised of Montreal Engineering Co., Swan Wooster Engineering, Inc., and Canadian Pacific Services.

The project involved an expansion of the existing production from the Bukit Asam coal mines to 2.2 million tons per year by 1984 and a new rail-and-sea transportation system for moving the coal to two 375-megawatt power generation stations, one of which is scheduled to begin supplying electricity to Jakarta and its surrounding area in 1984. The cost of the project was estimated at $1.07 billion, including $100 million for the cost of mine development and

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expansion, $450 million for the two generation stations at Suralaya, West Java, $84 million for railway, $85 million for sea transport facilities, and $350 million for transmission lines and grid.[36]

Following Shell's withdrawal from the production contract in September 1978, the Government of Indonesia through P.N. Tambang Batubara invited 22 foreign contractors to submit proposals for the reopening of its coal mines including significant deposits at Mahakan in East Kalimantan, which have been closed down for economic reasons. Successful bidders for eight coal concession areas along the coast of East Kalimantan were Mitsui and Nissho-Iwai of Japan; Rio Tinto, Inc., of Britain; Utah International, Inc., and Arco, Inc., of the United States; a Japanese consortium; and Yul San Co., Ltd., of South Korea, which dropped out later because of bankruptcy. Various production-sharing contracts were being negotiated during mid-1979. Exploration activities began immediately following the letting of the contracts.[37]

Petroleum and Natural Gas.—Indonesia oil output level was off in 1977, beginning a decline that continued through 1979. This declining trend was primarily due to a noticeable slowdown in oil exploration activities by the contractors during the 1975-77 period. However, Indonesia's oil production is expected to increase again starting in 1981 and reach 1.8 million barrels per day by 1983. This is to be the result of intensified secondary recovery from onshore and offshore oil wells and additional exploratory wells induced by a new "joint-venture production-sharing arrangement."[38] This new arrangement calls for a 50-50 sharing of all exploration, investment, and production costs by the interested party (the contractor) and the State-owned oil company (Pertamina).

Indonesia exported about 75% of its crude oil produced during the 1978-79 period. Of the total crude oil exported, about 45% went to Japan and 34% to the United States in 1978; about 57% went to Japan and 30% to the United States in 1979.[39] Although Indonesia's crude oil exports declined in volume, exports earnings from oil rose from $4.6 billion in 1978 to over $6 billion in 1979.

Under the third 5-Year Plan, Indonesia was to increase its oil production and expand its refineries. In 1978, about 130 exploratory wells were drilled and an offshore oilfield, southeast of Sumatra, was discovered. This new offshore field was to begin production in 1979.[40] During 1979, a total of 14 new production-sharing contracts were signed by Pertamina with numerous foreign oil companies. These contractors include Chevron Jambi, Inc., and Texaco Jambi, Inc., for onshore exploration in South Sumatra and offshore exploration near the Natuna islands; Indonesia Cities Services, Inc., for offshore exploration in the East Java Sea; Mobil Oil Indonesia for offshore exploration east of Aceh in North Sumatra and two offshore exploration programs around the Natuna islands in the South China Sea; Marathon for offshore exploration near the Natuna islands; Royal Dutch Shell Group for onshore exploration in Southern Irian Jaya; Esso for offshore exploration near the Natuna islands; and Phillips/Amoco for two onshore exploration programs in Irian Jaya. The total foreign oil companies' investment in Indonesia oil exploration rose from $230 million in 1978 to over $300 million in 1979.[41]

In line with the third 5-Year Plan, Indonesia would expand its Cilicap refinery in Central Java from its current 100,000-barrel-per-day (bpd) capacity to 300,000 bpd by 1982; its Dumai refinery in Sumatra would be expanded by 85,000 bpd and equipped with a hydrocracking plant; and its Balikpapan refinery in East Kalimantan would also be expanded to 260,000 bpd from 60,000 bpd. By the end of 1983, Indonesia's total refining capacity was projected to reach 800,000 bpd from the current 400,000 bpd.[42]

Following discovery of large deposits in Arun Aceh in North Sumatra and Badak in Eastern Kalimantan, Indonesia's gas production had tripled during the 1976 to 1978 period. The gas production reached an all-time high of 1 trillion cubic feet in 1979.

Indonesia's utilization of natural gas rose sharply during the 1977 to 1979 period and is expected to continue to rise through 1983. This rapid increase is to be a result of increasing use of natural gas as a raw material in expanding fertilizer production as well as an energy source in the fast growing cement, steel, and utilities industries. The domestic utilization of natural gas was further boosted by two newly opened LNG plants. The Arun LNG plant at Blang Lancang in Aceh, North Sumatra, started its operation in September 1978. The plant operates three trains capable of treating 24 million cubic meters per day of gas and producing about 4.8 million tons of LNG annually. The Bontang LNG plant in

Badak, East Kalimantan, had started its operation in August 1977 with two trains capable of treating 15 million cubic meters per day of gas and producing about 3.3 million tons of LNG annually.[43] Indonesia's LNG production was at the 6-million-ton level in 1979. This level was to be raised to 7.5 million tons in 1980 by adding four trains to the Arun plant and two trains to the Bontang plant. It was projected that the LNG production would reach 10.2 million tons in 1982 and 13.9 million tons in 1983.[44] Indonesia exported most of its LNG to Japan by specially built ocean-going vessels. In 1979, LNG exports earned over $500 million in foreign exchange.[45]

In 1979, Indonesia completed its West Java natural gas pipeline. The installation of this pipeline would enable Indonesia to save previously wasted natural gas.[46]

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[1] Economist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Indonesian rupiahs (Rp) to U.S. dollars at the rate of Rp415=US$1.00 for 1978 and Rp625=US$1.00 for 1979.

[3] U.S. Embassy, Jakarta, Indonesia. Foreign Economic Trends and Their Implication for the United States. No. [illegible], April 1980.

[4] Far Eastern Economic Review. Asia 1980 Yearbook. P. 181.

[5] U.S. Embassy, Jakarta, Indonesia. Foreign Trade in Bauxite and Alumina. State Department Airgram A-076, June 12, 1979.

[6] Trijono, Ir. Ichmad. Indonesia. Mining Journal, Mining Annual Review—1979 (London). P. 459.

[7] Pura, Raphail. Indonesia Discloses Details of the Plan to Cover Asahan Project's Cost Overrun. Asia Wall Street Journal, Sept. 28, 1978, p. 3.

[8] Japan Chemical Week. V. 19, No. 947, June 15, 1978, p. 1.

[9] Asian Mining. August 1979, p. 31.
U.S. Embassy, Jakarta, Indonesia. Asahan Hydroelectric Project. State Department Airgram A-022, May 10, 1979.
U.S. Embassy, Jakarta, Indonesia. Asahan Project Aluminum Smelter. State Department Airgram A-035, Aug. 1, 1979.

[10] Work cited in footnote 6.

[11] Mining Engineering. V. 31, No. 8, August 1979, p. 1197.

[12] Work cited in footnote 11.
Asian Mining Annual 1979. April 1980, p. 36.
World Mining (San Francisco). December 1978, p. 272.

[13] Work cited in footnote 6.

[14] Kennecott withdrew in 1977 and additional capital is still being sought.

[15] U.S. Embassy, Jakarta, Indonesia. Mining, Petroleum and Natural Gas—Market Review. State Department Airgram A-42, May 15, 1978, p. 14.

[16] U.S. Embassy, Jakarta, Indonesia. Indonesia Industrial Outlook Report: Minerals. CERP 0429, Apr. 27, 1979.
The figures are not included in the production in Statistics of Cikoto.

[17] Pages 459-460 of work cited in footnote 6.

[18] Ariwibowo, Ir. T. Krakatau Steel's New Facilities at Cilegon. Metal Indonesia, v. 2, No. 11, July 1978, pp. 3-4.

[19] Work cited in footnote 16.

[20] Page 458 of work cited in footnote 6.

[21] Asian Wall Street Journal. Apr. 20, 1979, p. 3.
Page 1196 of work cited in footnote 11.

[22] Mining Engineering. V. 31, No. 3, March 1979, p. 255.

[23] Mining Journal. Apr. 4, 1980, p. 272.

[24] Page 117 of work cited in footnote 11.

[25] Work cited in footnote 20.
In addition to 740,000 metric tons of measured tin reserves, Indonesia has 400,000 metric tons of inferred reserves, 200,000 metric tons of conditional resources, and an estimated 300,000 metric tons of undiscovered resources.

[26] Asian Mining. February 1980, p. 20.

[27] Works cited in footnotes 5 and 21.

[28] U.S. Embassy, Jakarta, Indonesia. Indonesia-French Geological Survey Agreement. State Department Telegram 7273, Feb. 9, 1979.
U.S. Embassy, Jakarta, Indonesia. Indo-French Agreement on Uranium Exploration Amended. State Department Telegram 8184, Apr. 17, 1978.

[29] Second work cited in footnote 12.

[30] Work cited in footnote 29.

[31] U.S. Embassy, Jakarta, Indonesia. Cement Industry of Indonesia. State Department Airgram A-38, Apr. 27, 1979, p. 2.

[32] The British Sulphur Corp., Ltd. Nitrogen. No. 120, July/August 1979, p. 15.

[33] Mainly for use in the construction of LNG facilities in Aceh and East Kalimantan.

[34] Work cited in footnote 29.

[35] Page 1195 of work cited in footnote 11.

[36] Asian Mining. May 1979, p. 30.

[37] Second work cited in footnote 21.

[38] Page 455 of work cited in footnote 6.

[39] Petroleum Economist. April 1980, p. 178.
Total export of crude in 1979 at 1,125,000 barrels per day times 365 days.

[40] Asian Mining. March 1978, p. 17.
Asian Mining. May 1978, p. 23.

[41] Page 17 of first work cited in footnote 40.
Kuala Lumpur Business Times. Dec. 12, 1979, p. 20.

[42] Petroleum News. May 1980, p. 36.

[43] Work cited in footnote 6.

[44] Page 33 of second work cited in footnote 12.

[45] Page 6 of work cited in footnote 3.

[46] Page 31 of second work cited in footnote 12.

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The Mineral Industry of Iran

By Janice L. W. Jolly[1]

Beginning in late 1978 and continuing into 1979, the mineral industry of Iran suffered from the traumatic events of a revolution, which was to severely affect the Iranian economy. In 1978, Iran's economy and society had begun to reflect the strains resulting from a rapid-pace development following the post 1973 oil boom. As early as 1977 the Government had recognized some of the problems and had decided to take a number of deflationary measures to cool the economy. Inflation and wage demands, which had reached rates of 40% or more, needed to be curbed. Other negative factors such as capital flight, low private investment, uneven distribution of income, and shortages in labor, housing, and social services further aggravated the economy. By September 1978, the situation erupted into widespread civil and economic disorder which recast Iran's entire economic course. At yearend 1978, oil production was reduced to less than domestic needs, the banking system was crippled, the construction sector was paralyzed, and such Government services as customs, essential to industrial production, were paralyzed. Unemployment became massive in 1979, which was estimated at 35% of the labor force. Strikes in the petroleum refining and distribution sectors resulted in widespread shortages of domestic cooking and heating fuels and Iran was forced to import some essential refined petroleum products. Despite lost oil production for the latter part of 1978 and early 1979, higher oil prices enabled the gross national product (GNP) for Iranian year 1979 to remain nearly the same as Iranian year 1978,[2] estimated at $70 billion[3] at current prices.

By the middle of 1979, new mineral development projects, some as much as 85% complete, had been reassessed by the new revolutionary Government, with some to be abandoned, such as the aromatics plant at Abadan, the Kalingas liquified natural gas (LNG) project, the French nuclear powerplants, and the IGAT-II natural gas pipeline. With loss of expatriate help, most projects were at least temporarily halted. Included in this category were the West German nuclear powerplants (over two-thirds completed), the Italian steel mill at Bandar Abbas, and the Sar Cheshmeh copper complex. Projects that were considered worth continuing included the Iran-Japan petrochemical complex, the Italian-constructed steel plant (to be relocated near Isfahan) Sar Cheshmeh and the gas recovery-reinjection (although modified) project in Khuzestan. Most foreign firms with outstanding contracts or joint ventures in Iran resumed contact with their Iranian colleagues after the revolution, but with differing results. In general, the Iranians sought a lower expatriate presence. Iran's formerly large foreign population was reduced to a few thousand legally documented workers. American involvement became particularly impossible by yearend 1979.

By August 1979, Iran had a cash-flow problem and the economy was sinking into deep depression. Despite months of unrest and disruptions of the economy, Iran was flush with cash from oil revenues, collected and deposited in foreign bank accounts throughout the world, but with most of the industrialization projects canceled there was little way of spending it. The whole posture of the new Government had been to cut and dismantled. There were no new economic plans for growth or industrial future of the country. A severe liquidity crunch occurred as Iranians held their savings out of banks, taxes went unpaid and uncollected, and a widespread rebellion occurred among both private and public workers making it impossible to achieve a steady level of productivity in any industry.

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No banks had deposits to lend, the Government slashed the budget by one-third, and huge raises of up to 400% were given to all Government workers to appease industrial unrest. A sudden end to the construction industry, a mainstay of Iran's economic boom, and an acute shortage of raw material spare parts and intermediate goods because of import disruptions combined to further strangle the economy.

In July 1979, the nationalization of banks, insurance companies, and most metal-processing and mining operations contributed to a growing pessimism of the international banking and investment community. Formerly regarded a good credit risk, Iran became a very uncertain risk by yearend 1979. The ambitious plans for modernizing Iran had called for large loans; Iran's total indebtedness was estimated at $6 billion, with $2.5 billion owed to U.S. banks. Most of Iran's foreign exchange, estimated at $9 billion, was also held in U.S. banks. On November 12, 1979, the U.S. Government officially froze all Iranian assets and funds held by U.S. banks and their foreign subsidiaries. Since most Iranian trade had been conducted in U.S. dollars, this was to have far-reaching consequences. By November 19, Iran had defaulted on interest payments due and several U.S. banks acted to accelerate the loans, demanding repayment and seizing Iranian assets in compensation. Morgan Guaranty Bank of the United States also made a successful move in the Federal Republic of Germany courts to attach the 25.02% Iran stake in Friedrich Krupp Hüttenwerke AG, the German steel and engineering corporation. Iran, in return, requested all future oil payments to be made in other currencies or to other banks.

PRODUCTION AND TRADE

Crude petroleum production for Iranian year 1978 was valued at $18.9 billion, down 9.2% compared with receipts of $21 billion for 1977. Although crude petroleum production was drastically reduced through much of 1979, higher prices resulted in revenues similar to the previous year. Petroleum prices, which had been relatively stable in early 1978, began to respond to the supply crisis generated by the Iranian revolution at yearend. The Organization of Petroleum Exporting Countries (OPEC) price agreement of a 10% increase for 1979 was a compromise between moderates and others who pressed for up to a 20% increase. Iran was to institute a 29% increase by April 1979, when Iranian light crude, which was priced at $12.81 per barrel in December 1978, was raised to $16.57 per barrel. By yearend 1979, Iranian light was selling at the official price of $23.50 per barrel and spot prices were as high as $43 per barrel. Iran was accepting only German marks, Japanese yen, or French francs as payment for oil after the United States froze Iran's dollar assets in late 1979. By yearend 1979, production was averaging 2.9 million barrels of crude oil per day, down from the 4 million barrels per day reached earlier in the year. Iran was diverting most production to exports to be sold mostly on the spot market at premium prices. Iran was planning to reduce its oil production further in 1980, and to look for even higher prices.

In 1978, the Oil Service Co. of Iran (OSCO) exported 989 million barrels of crude oil. National Iranian Oil Co. (NIOC) direct exports were 432 million barrels, and NIOC joint venture exports were 210 million barrels of crude oil. As a response to crude oversupply and poor demand of world markets early in 1978, Iran's exports had fallen back by nearly 16% to 4.75 million barrels per day. In April 1978, Iranian crudes were selling at discount rates in spot markets. By October 1978, however, the surplus of petroleum that had troubled the world's oil companies for the past year and a half, holding prices down, evaporated in the wake of the political turmoil in Iran. At mid-year 1978, as companies began to stockpile petroleum in anticipation of a January OPEC price increase, Iranian exports of crude and refined products averaged 5.1 million barrels per day for the 9 months ending September 22, which was only 2.1% lower than the 1977 average. Exports plummeted during October, however, to less than 1 million barrels per day, and on December 27, 1978, ceased altogether until March 1979. Exports of crude petroleum for 1979 averaged about 2.8 million barrels per day.

Nonoil exports, including other minerals and natural gas, were valued at $450 million for 1978, down about 14% compared with Iranian year 1977. Mineral ore exports formed about 3% of the total nonoil export value. Natural gas exports to the U.S.S.R. were about 614 billion cubic feet in 1978. Natural gas production and exports were halted for a period of about 3 months during the peak of Iran's political crisis. Resuming deliveries in April 1979, Iran supplied only about 35% of the normal natural gas provision to the U.S.S.R. for all of 1979. Iran's agreement with the U.S.S.R. to supply gas was to expire in 1985.

NIOC had a direct investment in a 42-inch Israeli crude oil transit pipeline between the Red Sea port of Eilat and Ashkelon on the Mediterranean. The line opened in 1970 for delivering Iranian oil to the Mediterranean for various customers and had a 1-million-barrel-per-day capacity. Delivery over the line ceased at the beginning of 1979.[4]

Table 1.—Iran: Production of mineral commodities[1] [2]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^{p}	1979^{e}
METALS				
Aluminum, primary ingot	30,600	21,100	25,500	14,000
Chromium: Chromite, gross weight	160,000	233,300	196,000	136,000
Copper:^{e}				
Mine output, metal content	^{e}6,000	13,500	20,000	5,300
Smelter	4,000	7,000	6,000	6,000
Refined	7,000	7,000	6,000	6,000
Iron and steel:				
Iron ore, gross weight thousand tons	1,070	1,100	1,500	600
Pig iron do.	625	^{e}700	^{e}900	800
Steel, crude do.	550	550	^{e}700	700
Lead:				
Mine output, metal content	35,000	40,000	30,000	28,000
Smelter^{e}	(3)	(3)	--	--
Manganese ore, gross weight	40,000	40,000	30,000	22,670
Zinc, mine output, metal content	72,000	61,500	^{e}45,000	40,000
NONMETALS				
Barite	230,000	184,650	200,000	NA
Cement, hydraulic thousand tons	6,100	7,256	12,000	9,000
Clays:				
Bentonite^{e}	50,000	23,400	40,000	NA
Fire clay	NA	72,201	NA	NA
Kaolin	200,000	111,202	180,000	NA
Feldspar	NA	3,000	NA	NA
Gem stones: Turquoise, crude	^{e}70	82	35	NA
Gypsum thousand tons	6,800	6,900	^{e}8,000	7,000
Lime^{e} do.	1,000	1,000	900	500
Magnesite	5,000	5,000	5,000	NA
Nitrogen: N content of ammonia	290,300	271,300	178,000	90,000
Pigments, mineral, natural	4,500	3,500	2,000	1,000
Salt, rock thousand tons	700	700	700	700
Sodium compounds: Caustic soda	18,000	NA	NA	NA
Stone, sand and gravel:				
Limestone thousand tons	^{e}8,000	9,000	15,000	NA
Marble do.	320	397	450	NA
Silica do.	300	300	NA	NA
Travertine do.	400	390	350	NA
Other do.	18,000	NA	NA	NA
Strontium minerals: Celestite^{e}	5,500	10,000	15,000	8,000
Sulfates, natural:				
Aluminum-potassium sulfate (alum)	NA	8,500	8,000	NA
Sodium sulfate (mineral not specified)^{e}	25,000	29,000	37,000	NA
Sulfur:				
Native thousand tons	188	^{e}188	^{e}150	75
Byproduct of petroleum and natural gas do.	399	^{e}400	^{e}300	200
Total do.	587	588	^{e}450	275
Sulfuric acid do.	280	280	^{e}200	100
Talc	NA	400	NA	NA
MINERAL FUELS AND RELATED MATERIALS				
Coal thousand tons	1,000	969	900	900
Coke do.	444	445	500	400
Gas, natural:				
Gross million cubic feet	1,776,225	2,069,504	1,947,595	1,100,000
Marketed do.	793,720	^{e}795,000	697,397	500,000

See footnotes at end of table.

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Table 1.—Iran: Production of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued				
Natural gas liquids:				
Propane thousand 42-gallon barrels	3,170	4,625	NA	NA
Butane do.	3,673	4,447	NA	NA
Natural gasoline and other do.	5,283	6,798	NA	NA
Total do.	12,126	15,870	NA	NA
Petroleum:				
Crude[4] do.	2,147,259	2,066,922	1,913,221	1,100,000
Refinery products:				
Gasoline:				
Aviation do.	3,166	2,619	2,931	2,000
Motor do.	29,474	32,248	33,996	30,000
Jet fuel do.	8,857	11,995	11,028	10,000
Kerosine do.	32,815	34,425	31,639	30,000
Distillate fuel oil do.	49,629	56,980	50,705	45,000
Residual fuel oil do.	96,072	102,920	100,195	90,000
Lubricants do.	824	2,760	3,376	3,000
Other:				
Liquefied petroleum gas do.	4,184	4,629	10,671	9,000
Naphtha and solvents do.	5,289	7,430		
Asphalt do.	5,215	NA		
Bitumen do.	NA	5,971		
Unspecified do.	3,075	604		
Refinery fuel and losses do.	16,783	11,483	4,386	4,000
Total do.	255,383	274,039	248,886	224,000

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, other types of crude construction materials (such as common clays, sand and gravel, and other varieties of stone) are also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] Data are for years beginning March 21 of that stated, except those for natural gas, natural gas liquids, and petroleum, which are for regular calender years.

[3] Revised to none.

[4] Excludes petroleum produced and reinjected into fields.

Table 2.—Iran: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS			
Aluminum metal including alloys, all forms	1,508	33	Afghanistan 30.
Arsenic, natural sulfides	5	NA	
Chromium: Chromite, 48% Cr_2O_3	5,400	NA	
Copper:			
Ore and concentrate	4,200	NA	
Metal including alloys	6	NA	
Iron and steel:			
Ore and concentrate	214	67	West Germany 67.
Metal:			
Scrap	--	2,589	Iraq 2,000; Oman 500; Japan 89.
Pig iron, ferroalloys, similar materials	161	103	Japan 98; Bahrain 3; Afghanistan 2.
Semimanufactures	1,563	1,609	Saudi Arabia 875; Afghanistan 490; United States 234.
Lead ore and concentrate	4,444	NA	
Silver waste and sweepings troy ounces	31,893	15,079	Libya 15,079.
Zinc ore and concentrate	32,765	7,500	United Kingdom 7,500.
Other ores and concentrates	--	1,000	U.S.S.R. 1,000.
NONMETALS			
Abrasives, natural:			
Crude, n.e.s	600	NA	
Grinding and polishing wheels and stones	676	1,059	U.S.S.R. 1,052; Afghanistan 7.
Barite	--	2	France 2.
Chalk	40	34	Afghanistan 34.
Clays and clay products:			
Crude:			
Kaolin	10	NA	
Fuller's earth	4	NA	
Fire clay	--	1	West Germany 1.
Other	1	NA	

See footnotes at end of table.

Table 2.—Iran: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
NONMETALS —Continued			
Clays and clay products —Continued			
Products:			
Refractory	10	100	Bahrain 100.
Nonrefractory	687	189	Bahrain 147; Kuwait 24.
Fertilizer materials:			
Manufactured:			
Potassic	21	15	Kuwait 15.
Other	3,075	3,000	Abu Dhabi 2,100; Kuwait 900.
Ammonia	9,151	100,001	Republic of South Africa 100,000; Qatar 1.
Graphite, natural	380	NA	
Gypsum	176	6	France 3; West Germany 3.
Lime	1	NA	
Pigments, mineral, including processed iron oxides	100	([2])	Afghanistan.[3]
Precious and semiprecious stones, except diamond value	$254,442	$265,377	United States $253,097.
Salt	1,603	2,103	Dubai 849; Oman 612; Kuwait 359.
Stone, sand and gravel:			
Dimension:			
Crude and partly worked:			
Calcareous	14,637	8,079	Italy 5,587; U.S.S.R. 1,000; Greece 720.
Slate	17,650	NA	
Worked:			
Slate	660	NA	
Paving and flagstone	10	35	Mainland China 35.
Other	258	155	Bahrain 81; Iraq 41; Switzerland 32.
Gravel and crushed stone	17,082	22,200	Kuwait 19,600; Qatar 1,800; Saudi Arabia 800.
Sand, excluding metal bearing	--	9	France 5; Austria 4.
Sulfur:			
Elemental:			
Colloidal	287,346	NA	
Other than colloidal	30,971	210,009	United States 100,000; Republic of South Africa 80,000; India 30,000.
Sulfuric acid	1	NA	
Other, crude	5,011	2,352	U.S.S.R. 2,350; Kuwait 2.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural[3]	983	2,255	Asia 2,255.
Coal, all grades, including briquets	337	33	Kuwait 32; Afghanistan 1.
Petroleum:[3]			
Crude and partly refined thousand 42-gallon barrels	901,725	392,842	Europe 167,924; Asia 122,301; America 74,793.
Refinery products:			
Gasoline do	12,938	72,452	Europe 34,610; Asia 21,997; America 12,373.
Kerosine do	1,716	2,026	Asia 1,825; Europe 105; Australia 56.
Distillate fuel oil do	12,661	4,268	Asia 3,008; Europe 609; America 514.
Residual fuel oil do	46,124	4,984	Europe 1,902; Asia 1,788; America 964.
Lubricants do	4	9	All to Asia.
Other:			
Liquefied petroleum gas do	5,755	4,878	Asia 4,155; Europe 603; Africa 120.
Mineral jelly and wax do	([2])	([2])	NA.
Bitumen and other residues do	--	22	All to Asia.
Petroleum coke do	152	NA	

NA Not available.

[1] Data reported for 1976 cover the period Mar. 21, 1976 to Mar. 20, 1977. Data reported for 1977 cover the period Mar. 21, 1977 to Dec. 21, 1977.

[2] Less than 1/2 unit.

[3] Destination of shipments reported by continent only, in most cases; detail by country not available except as shown.

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Table 3.—Iran: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS			
Aluminum:			
Bauxite ore and concentrate	122	279	West Germany 108; Japan 99; United Kingdom 72.
Oxide and hydroxide	58,323	16,555	United States 16,269; United Kingdom 115; West Germany 97.
Metal including alloys:			
Scrap	--	762	United States 732; United Kingdom 27; West Germany 3.
Unwrought	9,543	3,187	Hungary 1,000; Italy 983; United States 496.
Semimanufactures	17,931	23,826	West Germany 5,889; Switzerland 3,013; Japan 2,904.
Arsenic trioxide, pentoxide, acids	66	31	West Germany 30; Netherlands 1.
Beryllium metal including alloys, all forms	56	NA	
Chromium oxide and hydroxide	303	105	Italy 54; West Germany 21; Belgium-Luxembourg 14.
Cobalt oxide and hydroxide	79	21	United Kingdom 19; Belgium-Luxembourg 1; West Germany 1.
Copper:			
Matte	3	176	United Kingdom 176.
Metal including alloys:			
Scrap	2,497	2,153	Kuwait 1,918; Dubai 99; Qatar 96.
Unwrought:			
Unrefined	2	7	United Kingdom 7.
Refined, unalloyed	1	NA	
Master alloys	871	698	Belgium-Luxembourg 386; France 177; Japan 62.
Semimanufactures	36,976	31,505	NA.
Columbium and tantalum metals including alloys, all forms kilograms	41	NA	
Gold metal, all forms thousand troy ounces	3,068	886	Switzerland 801; West Germany 52; United Kingdom 16.
Iron and steel:			
Ore and concentrate kilograms	193	NA	
Metal:			
Scrap	502	1,289	Spain 500; West Germany 305; U.S.S.R. 277.
Cast iron	9,809	9,230	U.S.S.R. 8,969.
Ferroalloys	13,945	7,367	Norway 2,741; Japan 1,390; U.S.S.R. 797.
Steel, primary forms	272,264	584,352	Australia 267,941; Republic of South Africa 221,595.
Semimanufactures thousand tons	3,681	2,226	Japan 1,198; West Germany 382; Republic of South Africa 189.
Lead:			
Oxide	129	481	Bulgaria 419; West Germany 35.
Metal including alloys:			
Scrap	95	53	Kuwait 49.
Unwrought	1,001	997	United Kingdom 717; Belgium-Luxembourg 100; Netherlands 97.
Semimanufactures	340	814	Kuwait 387; United Kingdom 275.
Magnesium metal including alloys, all forms	394	11	United States 11.
Manganese oxide	3,820	1,847	United States 651; Singapore 517; West Germany 382.
Mercury 76-pound flasks	656	461	Netherlands 420; West Germany 30.
Molybdenum metal including alloys, all forms kilograms	43	610	Netherlands 610.
Nickel metal including alloys:			
Scrap	4	11	Canada 5; United Kingdom 4.
Unwrought	72	82	West Germany 48; United Kingdom 21.
Semimanufactures	284	204	United Kingdom 63; United States 45; India 38.
Platinum metal including scrap, waste, ash value, thousand	$62	$144	United States $44; United Kingdom $39; West Germany $57.
Silver metal including scrap, waste, ash thousand troy ounces	2,081	583	West Germany 423.
Tin:			
Oxide	18	30	Czechoslovakia 25.
Metal including alloys:			
Scrap kilograms	5,400	144	United States 144.
Unwrought	602	172	Malaysia 108.
Semimanufactures	9,680	425	United States 393.
Titanium oxide	429	395	West Germany 152; Finland 85; Bulgaria 64.
Tungsten metal including alloys, all forms	33	4	Japan 1; Netherlands 1.
Uranium and thorium metals including alloys, all forms kilograms	73	NA	

See footnotes at end of table.

Table 3.—Iran: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS —Continued			
Zinc:			
Oxides	1,786	1,179	Netherlands 250; West Germany 234.
Metal including alloys:			
Scrap	14	NA	
Unwrought	5,505	2,605	Australia 2,042; Japan 512.
Semimanufactures	505	179	Japan 109.
Other:			
Ores and concentrates:			
Of molybdenum, tantalum, titanium, vanadium, zirconium	2,331	1,392	Australia 902; India 490.
Of base metals, n.e.s	8	NA	
Ash and residue containing nonferrous metals	65	1	West Germany 1.
Metals including alloys, all forms:			
Alkali, alkaline earth, rare-earth metals	35	15	West Germany 13.
Base metals including alloys, all forms, n.e.s	288	395	Netherlands 271; U.S.S.R. 66; Spain 50.
NONMETALS			
Abrasives, natural:			
Crude, n.e.s	29,824	44,246	West Germany 29,008; Netherlands 15,225.
Dust and powder of precious and semiprecious stones, except diamond value, thousands	$313	$154	Ireland $146.
Grinding and polishing wheels and stones	727	585	West Germany 231; Italy 93; United Kingdom 78.
Asbestos	40,109	24,445	Republic of South Africa 7,667; U.S.S.R. 7,019; Canada 5,783.
Barite	205	242	West Germany 98; Turkey 86.
Boron materials, oxide and acid	545	300	Turkey 194; Italy 54.
Cement	1,375,380	2,132,746	U.S.S.R. 388,825; India 336,501; Spain 209,279.
Chalk	4,414	NA	
Clays and clay products (including all refractory brick):			
Crude:			
Fire clay	4,108	5,127	West Germany 1,751; Israel 1,114; Czechoslovakia 778; U.S.S.R. 715.
Kaolin	22,663	16,618	United Kingdom 10,459; Czechoslovakia 2,751.
Drilling mud	10,242	3,284	West Germany 1,706; Japan 974.
Fuller's earth	--	11	Italy 11.
Kyanite and sillimanite	2,557	2,352	Japan 1,302; Australia 390; West Germany 343.
Products:			
Refractory (including nonclay brick)	90,839	39,590	West Germany 11,436; Romania 5,578; United States 4,580.
Nonrefractory	17,291	30,400	Italy 18,867; Spain 2,063; Japan 2,040; France 1,252.
Cryolite and chiolite	1,535	1,420	Italy 1,005.
Diamond, all grades value	$578,373	$310,236	West Germany $118,200; Belgium-Luxembourg $69,503; India $54,403.
Diatomite and other infusorial earth	1,481	1,040	United States 392; France 176.
Feldspar and fluorspar	2,224	221	Finland 107; West Germany 55; Sweden 39.
Fertilizer materials:			
Crude:			
Phosphatic	73	4	West Germany 4.
Other	3,471	796	Bulgaria 450; Finland 330.
Manufactured:			
Nitrogenous	22,560	193,504	U.S.S.R. 57,819; Saudi Arabia 47,143.
Phosphatic, including Thomas slag	101,338	39,617	Kuwait 20,000; United States 10,305.
Potassic	48	47	Italy 20; West Germany 19.
Other, including mixed	93	26,520	Republic of Korea 15,800; Poland 10,685.
Ammonia	384	147	West Germany 119.
Graphite, natural	756	1,663	West Germany 1,483.
Gypsum and plasters	1,275	1,002	West Germany 900.
Iodine and bromine	255	578	United States 262; U.S.S.R. 87; Netherlands 84.
Lime	106	200	United Kingdom 131; Bahrain 27; India 24.
Magnesite	1,501	82	West Germany 82.

See footnotes at end of table.

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Table 3.—Iran: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
NONMETALS —Continued			
Mica:			
Crude	2,291	359	India 324.
Worked	8,257	19	India 13; Belgium-Luxembourg 5.
Pigments, mineral:			
Natural, crude	357	123	United Kingdom 88; Republic of South Africa 35.
Iron oxides, processed	438	803	West Germany 251; Japan 257.
Precious and semiprecious stones, except diamond:			
Natural value	$515,094	$379,196	Belgium-Luxembourg $60,087; United States $66,908; india $54,408.
Manufactured do	$500,266	$1,178,826	Switzerland $494,719; Japan $179,642; West Germany $174,355.
Salt	28	4,130	United Kingdom 4,055.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	17,208	11,029	Italy 4,666; Romania 1,344; Poland 1,227.
Caustic potash	298	729	West Germany 353; Romania 200; Poland 100.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Slate	208	102	Mainland China 102.
Other	2,980	NA	
Worked:			
Slate	5	NA	
Other	47	1	Hong Kong 1.
Dolomite	20	115	Norway 100.
Gravel and crushed stone	174	266	Pakistan 100; Mainland China 100.
Limestone, except dimension	178	282	West Germany 194.
Quartz and quartzite	3,746	1,742	Netherlands 652; Italy 300; West Germany 299.
Sand, excluding metal bearing	16,072	5,322	U.S.S.R. 3,940; Kuwait 913; Netherlands 251.
Sulfur:			
Elemental, all forms	744	503	West Germany 434; U.S.S.R. 50.
Sulfuric acid	92	212	U.S.S.R. 175.
Sulfur dioxide	64	51	Bulgaria 40.
Talc, steatite, soapstone, pyrophyllite	327	525	India 237; Japan 74; United Kingdom 61.
Other:			
Crude	533	364	Norway 157; Republic of Korea 60; United Kingdom 44; Spain 44.
Slag, dross, and similar waste, not metal bearing	4	17	Poland 17.
Oxides and hydroxides of magnesium, strontium, barium	322	218	West Germany 110; Netherlands 57.
Fluorine, elemental	5	46	Japan 42.
Other	172	82	West Germany 47; United States 22.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	227	231	West Germany 158.
Carbon black and gas carbon	982	553	West Germany 486.
Coal and coke, including briquets	5,142	3,074	U.S.S.R. 1,315; West Germany 1,696.
Hydrogen and rare gases	1,079	775	West Germany 185; United States 138; Italy 92.
Peat, including peat litter	(2)	35	Netherlands 19; Israel 15.
Petroleum:			
Crude and partly refined 42-gallon barrels	741,196	145	Italy 95.
Refinery products:			
Gasoline do	119	NA	
Kerosine and jet fuel do	--	120	France 120.
Distillate fuel oil do	3,059	433	U.S.S.R. 433.
Residual fuel oil do	7	NA	
Lubricants do	150,162	59,652	Belgium-Luxembourg 12,047; Romania 11,786; United States 11,540.
Mineral jelly and wax do	38,264	19,517	Mainland China 5,133; U.S.S.R. 5,096.
Other:			
Nonlubricating oils, n.e.s. do	3,990	7,406	Belgium-Luxembourg 3,949; Romania 1,006.
Liquefied petroleum gas do	2,282	5,788	France 3,750; Italy 1,786.
Pitch do	18,271	303	West Germany 165; Japan 138.
Pitch coke do	(2)	18,161	United States 18,161.
Petroleum coke do	77	NA	

See footnotes at end of table.

Table 3.—Iran: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum —Continued			
Refinery products —Continued			
Other —Continued			
Bitumen and other residues 42-gallon barrels	5,939	4,854	United Kingdom 3,981; U.S.S.R. 702.
Bituminous mixtures do	16,689	6,708	United States 3,303; Canada 1,291; West Germany 915.
Total do	238,859	122,942	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	12,996	1,644	United Kingdom 580; Belgium-Luxembourg 236; West Germany 132.

NA Not available.

[1] Data reported for 1976 cover the period Mar. 21, 1976, to Mar. 20, 1977. Data reported for 1977 cover the period Mar. 21, 1977, to Dec. 21, 1977.

[2] Less than 1/2 unit.

[3] Value only reported at $1,940.

COMMODITY REVIEW

METALS

Aluminum.—The Alcan Aluminium Ltd. (Canada), feasibility study for the proposed 150,000-per-ton-per-year aluminum smelter at Bandar Abbas was completed at yearend 1978. The cost of the project was estimated at $600 million. Power for the smelter was to be derived from domestic gas. At yearend 1979, however, this project was being reviewed by the new Government. The capacity of the Iran Aluminum Co. (IRALCO) smelter at Arak was being expanded to 125,000 tons per year. This expansion was expected to be completed by 1981. IRALCO had placed an inquiry for long-term supply of 150,000 tons per year of alumina from Japanese producers to cope with the planned expansion of the Arak smelter. IRALCO was now owned 95% by the Iranian Government, 4% by Reynolds Metals, and 1% by the Pakistan Government. Owing to power supply problems, the plant has had to operate at well below its rated capacity of 45,000 tons per year.

Copper.—As a result of the political and economic crisis, smelter operation and work on the Sar Chesmeh refinery was delayed. The National Iranian Copper Industries Co. (NICIC) was also to delay the first exports of blister copper. Exports totaling 120,000 tons had been contracted for delivery to Western Europe, Japan, and the United States by March 31, 1979, but by late 1978, little mining was being done, and the concentrator was not running at all. More seriously, construction of the smelter was halted, although the first furnace was due to be fired in January 1979; it was not commissioned until late in 1979. Shortage of fuel and power from the national grid, departure of U.S. expatriates, and disruption of banking and postal services and exchange controls making it impossible to get spare parts, were all causing production problems. When work became impossible, Anaconda Co. of the United States declared force majeure in January 1979 and canceled its contract in May 1979. Anaconda had finished 4 of its 7-year contract as technical advisor to NICIC. In June 1979, NICIC informed Parsons-Jurden of the United States and the Krupp-Mechim (West German-Belgium) joint venture that they could continue work on the project, but it was doubtful that the contract date for completion of the refinery by 1981 would be met.

Until the slowdown began at yearend 1978, the Iranian Mining and Metal Smelting Co. (IMMSC), under the Ministry of Industry and Mines, had also been active in development of several copper mines. These included the Talomsi, Maskani, Abbasabad, Chahar-Gonabad, and Mazra'eh copper mines. Output from the Talomsi and Maskani mines was estimated at 800,000 to 1 million tons of ore per year. The plant crude ore capacity at the Talomsi copper mine was 150 tons per day, producing a 35% to 40% copper concentrate. Geophysical and geochemical studies were completed at the Abbasabad copper mine, and 800,000 tons of extractable ore with 1% to 1.5% copper were determined with potential reserves of about 1.2 million tons. Installed 7 years ago, the Abbasabad concentrator had a crude ore capacity of 150 tons per day producing 35%

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copper concentrate. Current output of the Abbasabad Mine was only 80 tons of crude ore per day, most of which was being used by the Military Industries Organization of Iran. A second concentrator, with a 300-ton-per-day crude ore capacity, was to be installed. The available reserves at the Chahar-Gonabad copper mine was determined to be 2.9 million tons of 1.8% to 2% copper. Plans were to install a 300-ton-per-day flotation plant at Chahar-Gonabad during the sixth development program. The Mazra'eh copper mine was closed for a time in 1978 but was reopened with a 200-ton-per-day concentrator, and plans were being made to install a larger plant. The Mazra'eh Mine was estimated to have over 270,000 tons of 1.42% copper by a recent drilling program.

Other copper mines with activity in 1978 were described as follows: The Delijail copper mine, located 120 kilometers from the Tehran to Firuzkooh Road, renewed production after being shutdown since 1970. The mine was producing about 150 tons of copper ore per year and had an average grade of 6% copper. The Calateh Mehran Mine, located 110 kilometers southeast of Semnan, was also producing 150 tons per year of 7% copper ore. The Dovveh Taghi Mine, located south of Tarom, produced about 300 tons of ore per year with an average 4% copper.[5]

Iron Ore.—Iron ore for the National Iranian Steel Industries Corp. (NISIC) works at Ahwaz was to be initially imported from Kudremukh, India, but was expected to be supplied domestically from Iran's Gol-e-Gowar deposit by 1981. By yearend 1979, Iran was revising its contract for the construction of the Iran-financed pelletization plant at Kudremukh. The Iranian Government wanted to reduce its investment because it felt Iranian needs of iron ore pellets would not be on the scale originally visualized. National Iranian Steel Corp. (NISC) was obtaining iron ore from the Choghart deposit near Bafq, located approximately 540 kilometers from the plant. The Semnan iron ore mine was closed. Exploration for more iron ore reserves continued. Latest studies indicated Iran had about 1.6 billion tons of known iron ore reserves and projected reserves of 3,500 million tons.[6]

Iron and Steel.—By 1985, the finished steel capacity for the entire nation was planned to be 8 million tons per year, enough to meet domestic needs, but considerably scaled down from the original target of 14 to 16 million tons per year. Already about 70% completed, expansion at the NISC Aryamehr steel plant at Isfahan was to be continued. In August 1979, Iran and the U.S.S.R. agreed on an amended expansion plant that would cost about $369 million. Already the largest steel producer in Iran, producing about 550,000 tons of steel per year, NISC was scheduled to produce 2 million tons per year of pig iron and 1.5 million tons per year of raw steel. Established in 1973, NISIC had potential to surpass the NISC production at Aryamehr, but was still under development. NISIC's first direct reduction plant at Ahwaz went into production early in 1978 with an initial capacity of 230,000 tons per year. Two other direct reduction plants were also under construction at Ahwaz.

Even though some contracts had already been signed, progress on most projects was stopped or slowed down as the new Government reconsidered them, and equipment orders were canceled or delayed. Italimpianti, which had a $1.5 billion contract to supply equipment for the new steelworks at Bandar Abbas, renegotiated its contract in 1979. The plant was to be located near Isfahan under the terms of the new contract. After a period of suspension in early 1979, the Iranian Government asked the two West German companies, Lurgi Gesellschaften and Korf Stahl, to complete work on the pelletizer and Midrex direct reduction units at Ahwaz. Iranian Special Steel CO. (ISSCO) a joint venture with Creusot-Loire of France (30%), suspended plans for the special steel plant at Ahwaz after a number of delays.

Lead and Zinc.—According to the Iran Economic Service, about 75% of the lead and zinc mines in Iran had stopped working by early 1978, and the country had become an importer of industrial lead and zinc. The reasons given for mine closure were generally: (1) An increase in workers wages; (2) a drop in lead ore price in international markets; and (3) nonreturn of capital investment. Expansion at the Angouran Mine was delayed indefinitely. Even so, the mine had attained one-third of the production target with an annual production capacity of 100,000 tons of concentrate containing 60% lead and over 54% zinc. The Shahkuh, Kushk, and other smaller mines had a production capability totaling about 500,000 tons of lead-zinc concentrates, but these mines were operating at only about 50% capacity through the 1978-79 period.

The IMMSC was responsible for exploration and exploitation of lead-zinc deposits in several parts of Iran. In recent years it had spent more than $400 million on lead-zinc development including the lead mines of Nakhaluk, located near Zanjan, and the Zachkan and the Uzbashi-Chi Mines. Exploration and mining activities at the Nakhaluk Mine had reached the 160-meter depth in 1978. The concentrator capacity had been increased from 100 to 150 tons per day, and about 10,000 tons per year of 55% lead concentrates were being exported. IMMSC was also completing a new concentrator at the Nakhaluk Mine with an initial capacity of 600 tons of ore per day, later to be increased to 1,000 tons per day. At the Qanat Marvn lead mine, a new concentrator of 100-ton-per-day capacity was initiated. The output of the mine had been increased to 1,000 tons per year of 45% lead concentrate. Initial exploration of the Aria Chai lead mine was complete in 1978.[7]

NONMETALS

Cement.—The Aryamehr cement plant at Isfahan started operation in May 1978 and reached full operation with an initial 5,000-ton-per-day capacity in September. Full capacity was expected to reach 3 million tons per year. The plant, equipped with automatic machinery, was started in 1975 at a site located 40 kilometers southwest of Isfahan. The plant was a joint venture by the Military Procurement Organization and the NISC that hold 80% and 20%, respectively. Three diesel generators were installed to produce 50 megawatts of electricity. The National Iranian Gas Co. (NIGC) was constructing a pipeline to supply natural gas to the plant, whereas in 1978, gas was supplied by cylinders. The plant cost $230 million to build.

Cement production in 1978 was about 12 million tons. The country's requirements were estimated at 9.7 million tons, and local consumption had been increasing by 22% per year. Before the revolution, Iran had expected to become an exporter of cement with increased capacity outstripping consumption. By 1979, however, cement production was averaging about 25,000 tons per day. Domestic demand also dropped as construction projects were canceled. Construction permits were no longer required for the purchase of cement.

Gypsum.—Gypsum was being produced by the IMMSC and the Tehran Gatch Co., Ltd. With construction continuing at high levels, about 7 million tons of plaster was made during Iranian year 1978, which was about a 20% increase over the previous year.

Fluorite.—Several new deposits were producing about 9,000 tons per year for use in the local steel industry.[8]

Phosphate Rock.—The French Bureau de Rècherches Geologiques et Miniéres (BRGM) was doing mineral prospecting and mapping in Khorassan and, in 1978, was requested by the National Petrochemical Co. (NPC) to undertake technical-economic studies of previously discovered phosphate deposits located south of Isfahan.

Strontium.—Strontium Co., a subsidiary of the Simiran Group, was producing 15,000 tons per year of hand-sorted celestite ore from the Nakhjir deposit. Located in the northwestern part of the salt desert Dasht-i-Kavir, and southeast of Tehran, the celestite was sold to the U.S.S.R. and Japan on a minimum 90% $SrSO_4$, maximum 2% $BaSO_4$, and maximum 2% SiO_2 basis. The average $SrSO_4$ content of the deposit was 91.48%, which could be upgraded to 94% by hand sorting. Reserves were given as 1 million tons of proven ore, and 3 million tons of possible ore. Mining was by opencast extraction along the crest of the hill. The deposit, with an average thickness of 2.5 meters, was a stratiform occurrence in a marine marl (gypsum)-clay-limestone sequence that extended over a distance of 4 kilometers.[9]

MINERAL FUELS

Coal.—The NISC reported the discovery of new coal deposits in the southern part of the Dasht-i-Kavir salt desert. The discovery, located between Naiband and Tabas, was the result of a joint exploration effort by Iranian and Russian geologists who have been exploring a 100,000-square-meter area of the salt desert for coal, iron, and water for the past year. Reserves in this area were estimated at 20 billion tons.

Production of coke for the Iranian year 1977 was increased by 1,200 tons compared with the previous year. The coke section at the Aryamehr Steelworks also produced 2.5 billion cubic meters of usable coke gas and 400 tons of phenol. Tar (114,000 tons), ammonium sulfate (24,800 tons), and sulfuric acid (18,400 tons) were other byproducts produced. Coke consumption at the Aryamehr Foundry was decreased from 715.8 kilograms to 507 kilograms for production of each ton of cast iron.[10]

Natural Gas.—Associated and nonassociated proven gas reserves were estimated at 800 trillion cubic feet and about 20% of the proven world reserves. By 1979, Iran had decided in principle not to go ahead with any new schemes to export gas by pipeline or in liquified form. Deliveries of

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natural gas to the U.S.S.R. were also severely curtailed, and were estimated at about 56% of the contracted volume in July 1979. Production in early 1978 was about 5.6 billion cubic feet per day. About 48% of the gas was being flared, compared with 90% in the early 1960's. About 31% of the gas utilized was used in the secondary petroleum recovery, gas-injection program, 30% was being exported to the Soviets through the IGAT-1 pipeline, 10% was used domestically, and about 17% was used as feedstock for natural gas liquids and petrochemicals.[11] Natural gas deliveries to IGAT-I ceased in October 1978, started again on November 19, only to be terminated again in early 1979. Prerevolutionary levels of daily gas exports to the U.S.S.R. stood at 895.6 million cubic feet daily. During 1979, there was a shortage of associated gas for export because of reduced crude oil production. The export portion of the IGAT-II pipeline project was canceled because it was considered uneconomical and not in the nation's interest.

In 1978, NIOC announced that gas reinjection in the Khuzestan oilfields had raised the oil recovery factor by 5% to 10%. Without these secondary recovery measures, oil pressures and production in these fields would drop. Gas requirements for the injection program were expected to amount to 8 billion cubic feet per day, but this demand may be modified under the new national directive. This program was approved for continuing under the new Government; but, by yearend 1979, maintenance in the oilfields was virtually nonexistent and oil pipeline after pipeline throughout the country was being shut down.

By yearend 1978, the LNG (liquefied natural gas) deal with Columbia Gas Systems of the United States was shelved. The Kvaener Group of Norway, as builder and financier of the plant, also withdrew. Columbia and Consolidated Natural Gas, which became joint purchaser of the LNG, were to renegotiate price with NIGC while a new plant builder was sought,[12] but by yearend 1979 negotiations had ceased.

Agreements for the supply of LNG to Japan were signed in 1978 for NIGC to supply Japan Kalingas with 2.8 million tons per year over 20 years starting in 1982. A group of Japanese companies (Mitsubishi Heavy Industries, Ishikawajima-Harima Heavy Industries, Hitachi Shipbuilding, and Kobe Steel) were to construct the $762 million liquefaction plant that reportedly would be ready for operation by 1982. R.J. Brown and Associates were to design and engineer the Pars field gas-gathering system that would move gas from six offshore complexes to an onshore terminal where the condensate would be piped to the Kalingas LNG plant. By 1979, however, the Kalingas project was reported canceled.

The Joint-Stock Ocean Co. of Iran, a joint venture formed in 1975-76 with NPIC and the Ocean Gas Co. of France, received the first Iranian ship designed to transport liquefied gas and ammonia in early 1978. Called the Razi, the ship had a 70,000-cubic-meter capacity and would make its first commercial trip from Kuwait and Saudi Arabia to the United States. In October 1979, two new gas finds near Gachsaran were announced by NIOC and were a sign that the NIOC exploration program was again functioning.

Nuclear Energy.—By early 1979, Iran had decided to scrap its ambitious nuclear energy program. The decision affected the $3.6 billion two atomic powerplants at Büshehr that were being constructed by Kraftwerk Union, a subsidiary of Siemens AG of the Federal Republic of Germany. The Iranian Labor Ministry refused to renew the work permits for 200 Germans working at Büshehr, and two installments of $495 million each had not been paid. By July 28, 1979, Kraftwerk Union withdrew from the project to cut further losses. Work on the plants was 80% complete, and they had been expected to go onstream in 1980, producing 2.4 million kilowatts of electricity. Iran had already paid $2.87 billion to Kraftwerk for the project construction. The new revolutionary Government believed the project to be too costly to maintain. Framatome of France was also affected by this decision as it had contracted for two nuclear plants at a cost of $2.03 billion. The French had been arranging a barter-for-oil deal in payment for the plants.

At mid-1978, Australia and Iran signed a nuclear safeguard pact on the supply of uranium ore. The agreement followed 4 years of interrupted negotiations. Deliveries of 15,000 tons yearly of uranium were to be supplied over a 5-year period beginning in 1980. Preliminary initialing of a final nuclear nonproliferation treaty was also carried out in 1978 with the United States after 3 years of negotiations. An Iranian concession not to purchase a reprocessing plant had broken the negotiations deadlock. By yearend 1979, however, the need for such quantities of uranium was in doubt.

Petrochemicals.—The Shahpur Chemical Co., a subsidiary of the NPC, was upgraded in 1978 to 230,000 tons per year diammonium phosphate and 225,000 tons per year P_2O_5 in the phosphoric acid plant by "debottlenecking." New facilities were constructed including an ammonia plant, a urea plant, and two sulfuric acid units. Expansion of the fertilizer complex at Shiraz was about 75% complete and negotiation for contracts was under way for completion of the project in 1980. The Iran-Japan Petrochemical Co. (IJPC), a joint venture with NPC 50%, Mistui & Co., Ltd. 4%, Toyo Soda 30%, Mitsui Toatsu 15%, Mitsui Petrochemical Co. 5%, and Japan Synthetic Rubber Co. 5%, were to continue building a petrochemical complex at Bandar-e Shahpur, which was 85% complete at yearend 1978. The complex was centered on a 300,000-ton-per-year ethylene unit. At yearend 1979, the Japanese Government was considering the possibility of contributing an additional $228 million for the completion of the project abandoned through most of 1979. Now called the Bandar Khomeini Petrochemical project, gas supplies were guaranteed by NIOC. Parsons Engineering of the United States was to build the gas collection plant under the original contract, but by yearend 1979 none of the Parsons Group was on site and the future of the Parsons contract was under discussion. Work on the Bandar Khomeini project was scheduled to resume in January 1980.

Petroleum.—*Exploration.*—A general decline in exploration efforts continued through 1978-79. Diminex of the Federal Republic of Germany discovered oil in two wells on its tract around Abadan in 1978, but its commerciality was unknown. NIOC's exploration efforts were concentrated near Shiraz.

Production.—Petroleum production for 1978 averaged 5.2 million barrels per day, down almost 9% from the 5.7 million barrels per day produced in 1977. Crude production for the last 3 months of 1978, was to fall to the lowest levels in 26 years because of civil distrubances. In 1978, Iran was producing a ratio of 53% heavy oil crudes to 47% light crudes, which had changed from 52/48 in favor of light crude a few years ago. By 1982, this ratio was expected to be 57% heavy and 43% light crude.

Crude oil producing companies included the OSCO, which produced 89% of the total in 1978, and several NIOC joint ventures. OSCO was owned by British Petroleum (BP) 45%, Shell Oil 14%, Compagnie Francaise des Petroles (CFP) 6%, and by Exxon, Mobil, Texaco, Gulf, and Iricon Agency with 7% each. The joint ventures included: Iran Pan American Oil Co. group (IPAC) (Standard Oil of Indiana 50%, NIOC 55%); the Societe Irano-Italienne des Petroles Group (SIRIP), (Azienda Generale Italiana Petrole (AGIP) 50%, NIOC 50%); the Lavan Petroleum Co. (LAPCO), Atlantic Richfield Co., Murphy Oil Corp., Sun Oil Co., and Union Oil Co., each with 12 1/2%, and NIOC 50%); and the Iranian Marine International Co. (IMINOCO) (Phillips Petroleum, AGIP Oil, and Natural Gas Commission of India, each with 16 2/3% and NIOC 50%). NIOC-OSCO's 1973 production and sales agreement was to expire in December 1978, and at yearend, all negotiations to renew it came to a halt.

In September 1979, a purge of managing officials in NIOC lead to a shift to hard line policy, not only affecting OSCO negotiations, but also changes in production and pricing policy. Influential religious leaders were calling for reduced output and an end to price restraint. The newly appointed NIOC chairman announced that Iran would no longer work through OSCO and that Iran would probably nationalize the joint ventures.

Iran's crude oil reserves were estimated at 350 billion barrels with 330 billion barrels located in the southern Khuzestan area. With a recovery factor of about 18%, this translates into proven reserves of about 65 billion barrels. An additional 20 billion barrels were expected to be recovered by the secondary recovery, gas-injection program. NIOC budgeted $2 billion for oil exploration and development for the year March 1978 to March 1979. Most of this was to be spent on gas injection for pressure maintenance in the Khuzestan oilfields. Water injection was planned for a number of offshore fields, including Darious, Kharg, Raksh, and Rostam while Sassan was to be provided with both water and gas injection facilities.

The NIOC service contractor, Sofiran (Enterprise de Recherches et d'Activities Petroliers (ERAP) 40%, Mitsubishi Oil Development Co. 40%, and Societe Nationale de Petroles d'Aquitaine 20%), began production from the offshore Sirri "C" and Sirri "D" fields during the second week of June 1978. Initial production rate was about 3,000 barrels per day, but by August 1978 had reached 18,000 barrels per day. Production had been expected to be 80,000 barrels per day by 1980 before the changes in direction were announced by the new Iran-

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ian regime. It also had been planned that when production from "C" and "D" began to decline, another small field, the Sirri "E" was to be developed. Three 1-million-barrel tanks were constructed on Sirri Island. Crude oil from these fields was 30% API with a very low sulfur content.

Refining.—The new refinery at Tabriz, with estimated capacity of 80,000 barrels per day, was inaugurated in June 1978. The Italian Co., Snam Progetti S.p.A., was responsible for the design, engineering, and construction of the project for NIOC. The Isfahan refinery, consisting of two 100,000-barrel-per-day units was 95% complete. Fluor Corp., of the United States, in a joint venture with Thyssen Rheinstahl Technic Gmbh of the Federal Republic of Germany, was constructing the plant, which was halted during the revolution. Although work was restarted in late 1979, the refinery was not to be completed until the middle of 1980. Talks continued during 1978 with the Japanese for a new 250,000-barrel-per-day export refinery at Bushehr. Under discussion since 1973, the project was running into obstacles as the Japanese Government wanted both the capacity (revised from 500,000 tons) and completion date adjusted. NIOC also planned to take interest in a 60,000-barrel-per-day refinery to be built in Korea and a 25,000 barrel-per-day refinery in Senegal. Iran also participated in refineries at Madras, India (13%), and Sasolburg in South Africa (17 1/2%).

With installation of a new unit in February 1978, the Abadan refinery was increased to a 640,000-barrel-per-day capacity. Normally an export-oriented refinery, the Abadan refinery was the only plant in operation in early 1979, when disturbances and labor strikes had paralyzed the industry. Fuel shortages became acute in early 1979 with refining and distribution of petroleum products disrupted. With normal reserves exhausted, the entire production of the Abadan refinery was diverted to domestic markets. The product tanks at Abadan were full of unneeded and unwanted fuel oil. The crude oil tanks at Kharg Island were filled with fuel oil as a stop-gap measure. Fewer than 300 workers were operating the Abadan refinery at the peak disturbances in late 1978 and early 1979, when about 2,000 were supposed to work each shift under normal conditions. The Tehran (Rey) Refinery, the second largest in Iran, was completely shut down for several weeks in June 1979, because of technical problems. By September 1979, Iran's five operational refineries had a crude throughput in percent of capacity as follows: Abadan 95%, Tehran 95%, Tabriz 75%; Shiraz 90%, and Kermanshah 60%. Iran's actual average daily refinery throughput was estimated at just over 700,000 barrels per day.

Uranium.—Exploration for uranium deposits in Iran made considerable progress during 1978, although actual mining operations had not yet begun. Mines were to be developed near Kalardasht on the northern slopes of the Elborz Mountains in Mazandaran and at Sarkahnlu in the east, where 5 grams uranium per ton occurred in graphitic ore.

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[1] Physical scientist, Branch of Foreign Data.

[2] All data for Iranian calendar year begin on March 21 of the year indicated and end on March 20 of the following year.

[3] Where necessary, values have been converted from Iranian Rials (Rls) to U.S. dollars at the rate of Rls70.50=US$1.00.

[4] Middle East Economic Survey, (Cyprus). Iran. V. XXII, No. 31, May 21, 1979, p. 11.

[5] Tehran Economist, (Tehran). Details on Several Major Copper Mines Given. Apr. 8, 1978, p. 24.

[6] Tehran Journal, Tehran. Explorations Continued for More Ore Reserves. Mar. 14, 1978, p. 2.

[7] Metal Bulletin Monthly Supplement. Iran Mining in the Public Sector. November 1978, p. 53.

[8] Economic and Social Commission for Asia and the Pacific, Committee on National Resources, (Bangkok, Thailand). Activities of Member Countries, Mineral Development Activities in Iran. 6th Session, Oct. 31 - Nov. 2, 1979, 7 pp.

[9] Schiebel, Walther. New Strontium Deposit in Iran. Industrial Minerals, (London). No. 132. September 1978, pp. 54-58.

[10] Ettela't, (Tehran). Coke Production Up. Jan. 4, 1978, p. 29.

[11] Middle East Economic Survey, (Cyprus). Iran's Energy Perspective in the 1980's. V. XXII, No. 4, Nov. 13, 1978.

[12] Petroleum Economist, (London). Iran. V. XIV, No. 1, November 1978, p. 184.

The Mineral Industry of Iraq

By David E. Morse[1]

The production and export of crude petroleum continued to be the most important mineral and economic activity in Iraq during 1978 and 1979. Output of crude oil increased sharply in 1979, and Iraq moved up from third place in 1978 to the second largest Middle-East petroleum exporter in 1979. Important contracts were signed in 1978 and 1979 to make use of a significant portion of associated natural gas output that had been flared and to extract liquids and sulfur prior to distributing natural gas to new industrial facilities.

Iraq's cement and nitrogenous fertilizer industries underwent a multiple increase in capacity and output. New petroleum refineries were completed and were under construction in 1979. Iraq's first major iron- and steel-making complex began operations. A large-scale phosphate mine and fertilizer complex was under construction in northern Iraq. New salt-producing facilities and a $1 billion petrochemical complex were being built in the south. Iraq was an important producer and exporter of elemental sulfur in 1978 and 1979. A variety of crude construction materials, gypsum, and lime were produced for the domestic market.

Iraq was an active member of both the Organization of Arab Petroleum Exporting Countries (OAPEC) and the Organization of Petroleum Exporting Countries (OPEC). Iraq and other members of OPEC instituted a succession of price increases for crude oil in 1979 after maintaining a nearly constant product in 1978. Owing to its large 1979 increase in output, Iraq was able to sell significant volumes of crude oil on the spot market at a price well above that received from contractual customers. In 1979, Iraq also reduced liftings of many traditional customers when contracts were renewed and increased sales on a government-to-government basis, especially with developing nations.

The Government continued its policy of strict state control over the nation's economy. The economy was in a state of rapid expansion; buoyed by oil revenues of $10.9 billion[2] in 1978 and an estimated $20 billion in 1979, the gross national product (GNP) grew at an impressive rate of 22% in 1978 and 35% in 1979. The 1976-80 5-year development plan was developed to provide a balanced economy based on the oil, industrial, and agricultural sectors; however, overall economic development has been hampered by a shortage of skilled workers and managers in addition to an inadequate infrastructure.

Iraq planned to increase the supply of skilled workers without requiring foreign labor by a major expansion of vocational, technical, and university training programs. A compulsory education program for both sexes was instituted in the 1978-79 academic year, which had as its major goal the eradication of illiteracy.

Important investments were made to develop the nation's highway system, ports, railways, and airports. Major projects were nearing completion to expand electricity generating capacity from the 950 megawatts of 1977 to over 4,000 megawatts. The high-voltage electric distribution grid was being expanded, and electrification of rural villages was being implemented. Iraq's long-term goal of self-sufficiency in food production was to be accomplished by the construction of large-scale irrigation projects and attendent hydroelectric flood control dams cn the nation's major rivers. The long period of time required for these projects to be completed meant that agricultural output will not be effected for many years and,

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in the interim, the agricultural growth target of 7% per year was to come from increased mechanization on land presently under cultivation and by substantial increase in livestock, poultry, and egg output.

PRODUCTION AND TRADE

Iraqi mineral output, especially in the hydrocarbon sector, increased markedly in both 1978 and 1979. New plants were responsible for the significant increase in cement and fertilizer output. New facilities for raw steel and sponge iron production were commissioned.

Crude petroleum exports continued as the nation's most important foreign exchange earner in 1978 and 1979 and represented more than 98% of the value of all exports. Sulfur, cement, and chemical fertilizers were other major mineral industry exports. Detailed information on Iraq imports and exports has not been available since 1976. Crude petroleum and sulfur export statistics were not reported by the Iraq Statistical Organization in the 1975 and 1976 Iraqi Foreign Trade Statistics.

Table 1.—Iraq: Production of mineral commodities

Commodity[1] and unit of measure	1976	1977	1978[p]	1979[e]
Cement, hydraulic .... thousand metric tons..	2,728	3,170	4,600	5,100
Gas,natural:				
Gross .... million cubic feet..	380,000	[e] [2]370,802	[e] [2]388,460	560,000
Marketed[3] .... do....	74,408	56,502	100,000	140,000
Gypsum[e] .... thousand metric tons..	160	160	160	163
Iron and steel: Crude steel............ metric tons..	--	--	50,000	150,000
Natural gas liquids:				
Natural gasoline .... thousand 42-gallon barrels..	[e]960	1,200	[e]1,250	1,250
Propane and butane .... do....	[e]1,700	2,500	[e]3,000	3,000
Nitrogen: N content of ammonia.... thousand metric tons..	[e]135	136	181	450
Petroleum:				
Crude .... thousand 42-gallon barrels..	881,621	857,093	935,130	1,250,000
Refinery products:				
Gasoline............ do....	5,549	8,103	12,254	13,000
Jet fuel .... do....	1,341	4,708	1,935	2,000
Kerosine .... do....	3,490		5,160	5,800
Distillate fuel oil............ do....	8,432	8,541	12,899	12,900
Residual fuel oil .... do....	8,568	9,417	14,189	15,000
Lubricants .... do....	372	390	580	600
Other .... do....	7,360	9,344	13,609	14,200
Refinery fuel and losses .... do....	2,130	8,444	3,870	4,000
Total .... do....	37,242	48,947	64,496	67,500
Salt .... thousand metric tons..	[e]64	82	82	90
Sulfur, elemental:				
Native, Frasch............ do....	582	620	600	600
Byproduct[e] .... do....	40	40	40	40
Total .... do....	622	660	640	700

[e]Estimate. [p]Preliminary.

[1]In addition to the commodities listed, lime and a variety of crude construction materials (clays, stone, and sand and gravel) are also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2]Reported as estimate.

[3]Includes reinjected, if any.

Table 2.—Iraq: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal destinations, 1976
METALS			
Oxides, hydroxides, peroxides of metals	1,000	--	
NONMETALS			
Cement .... thousand tons..	100	2,774	United Arab Emirates 1,774; Kuwait 1,000.
Chalk............	27	59	All to Kuwait.
Clay products, nonrefractory	--	872	All to Saudi Arabia.

See footnotes at end of table.

Table 2.—Iraq: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal destinations, 1976
NONMETALS —Continued			
Fertilizer materials:			
Manufactured, nitrogenous	100	402	All to Bahrain.
Ammonia	--	15	All to Jordan.
Gypsum and plasters	7,243	12,022	Kuwait 7,832; United Arab Emirates 3,003; Qatar 699.
Lime	3,177	3,005	Kuwait 2,955; Jordan 50.
Stone, sand and gravel:			
Dimension stone, crude and partly worked	1,229	6,169	Kuwait 5,549; Qatar 320; Bahrain 300.
Gravel and crushed rock	100	--	
Sand, excluding metal bearing	--	2,120	Kuwait 1,900; Syria 220.
Sulfuric acid	--	2,612	All to Jordan.
Other: Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s.	300	401	Do.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	62,298	16,117	Somalia 9,100; Kuwait 3,601; Sudan 3,416.
Gas, manufactured	31,200	--	
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	757	765	NA.
Refinery products:			
Gasoline do	929	677	Netherlands 234; Switzerland 206; Bermuda 129.
Kerosine and jet fuel do	1,134	1,278	Pakistan 819; Bangladesh 353; Switzerland 106.
Distillate fuel oil do	1,438	3,202	India 1,063; Japan 925; Belgium-Luxembourg 243.
Residual fuel oil do	1,261	2,688	Vietnam 1,400; Bermuda 321; Switzerland 314.
Lubricants do	220	--	
Mineral jelly and wax do	24	12	Syria 7; West Germany 4; Pakistan 1.

NA Not available.

Table 3.—Iraq: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
METALS			
Aluminum:			
Oxide and hydroxide	1	2	India 2.
Metal including alloys:			
Scrap	12	--	
Unwrought	65	4,645	Mainly to Bahrain.
Semimanufactures	6,760	9,100	Hungary 2,443; Japan 867; Greece 833.
Arsenic:			
Natural sulfides	30	--	
Trioxide, pentoxide, acids	5	--	
Cobalt oxide and hydroxide	4	1	All from Japan.
Copper metal including alloys:			
Unwrought	23	2	All from United Kingdom.
Semimanufactures	5,809	2,612	United Kingdom 1,115; Japan 608; U.S.S.R. 161.
Iron and steel metal:			
Pig iron, including cast iron	7,509	416	United Kingdom 200; Egypt 157; West Germany 55.
Sponge iron, powder, shot	13,814	42,971	India 28,045; Spain 14,000; Japan 897.
Ferroalloys	--	1,655	Japan 980; France 675.
Steel, primary forms:			
Puddled bars, etc	6	--	
Blooms, billets, slabs, sheet bars	67	21	West Germany 14; Austria 6.
Coils for rerolling	10	1	Mainly from United Kingdom.
Tube and pipe blanks	368,367	200,920	Japan 133,096; West Germany 25,978; Italy 19,420.
Semimanufactures:			
Wire rod	3,778	3,807	Japan 2,647; U.S.S.R. 932; West Germany 175.
Other bars and rods	514,222	369,863	Japan 294,750; Czechoslovakia 29,970; U.S.S.R. 18,192.
Angles, shapes, sections	198,347	164,880	France 51,533; United Kingdom 40,482; Czechoslovakia 25,095.
Universals, plates, sheets	162,620	173,257	Japan 69,283; West Germany 32,947; Czechoslovakia 27,465.

See footnotes at end of table.

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Table 3.—Iraq: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
METALS —Continued			
Iron and steel metal —Continued			
Semimanufactures —Continued			
Hoop and strip	1,101	858	West Germany 343; Japan 289; Belgium-Luxembourg 113.
Rails and accessories	503	3,175	United Kingdom 1,548; U.S.S.R. 1,116; India 233.
Wire	22,134	35,268	Japan 20,504; U.S.S.R. 4,538; West Germany 3,570.
Tubes, pipes, fittings	54,865	50,599	Japan 15,893; China, mainland, 11,175; West Germany 11,015.
Lead:			
Oxide	22	20	All from West Germany.
Metal including alloys:			
Unwrought	19	2,547	United Kingdom 2,420; Austria 82; Denmark 45.
Semimanufactures	42	22	United Kingdom 14; Belgium-Luxembourg 6; Romania 2.
Magnesium metal including alloys:			
Unwrought	500	--	
Semimanufactures	--	1	All from United Kingdom.
Manganese oxide	671	--	
Mercury 76-pound flasks	558	150	All from Spain.
Nickel metal including alloys, all forms	119	6	Mainly from Greece.
Platinum metal including alloys, all forms thousand troy ounces	482	968	Mainly from United Kingdom.
Tin metal including alloys:			
Unwrought	51	59	United Kingdom 33; Malaysia 23; Netherlands 2.
Semimanufactures	117	63	Belgium-Luxembourg 43; United Kingdom 18.
Titanium oxide	1,094	1,243	United Kingdom 580; Netherlands 228; West Germany 224.
Zinc:			
Oxide	257	34	Japan 21; France 11; United Kingdom 2.
Metal including alloys:			
Unwrought	68	329	Japan 309; North Korea 15; Poland 5.
Semimanufactures	860	443	Japan 270; Belgium-Luxembourg 147; United Kingdom 26.
Other:			
Ores and concentrates of molybdenum, tantalum, titanium, vanadium	24	--	
Oxides, hydroxides, peroxides of metals	243	1,139	Belgium-Luxembourg 400; India 367; United Kingdom 206.
Metals including alloys:			
Metalloids	8	--	
Alkali, alkaline-earth, rare-earth metals	34	--	
Pyrophoric alloys	6	([1])	NA.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	416	--	
Grinding and polishing wheels and stones	746	483	Syria 227; United Kingdom 98; Denmark 60.
Asbestos	1,482	1,306	Botswana 1,070; Canada 214; United Kingdom 13.
Barite and witherite	27,540	35,752	Kuwait 22,601; India 12,027; France 598.
Cement	34,120	72,621	India 30,636; U.S.S.R. 12,933; Turkey 10,751.
Chalk	97	--	
Clays and clay products (including all refractory brick):			
Crude	37,245	35,707	India 13,285; Turkey 10,838; France 4,310.
Products:			
Refractory (including nonclay brick)	10,661	12,709	Netherlands 2,924; West Germany 2,365; Austria 2,340.
Nonrefractory	24,808	9,734	Spain 4,728; Japan 1,350; Bulgaria 921.
Diamond, gem, not set or strung	50,000	60,000	India 40,000; Belgium-Luxembourg 20,000.
Fertilizer materials:			
Manufactured:			
Nitrogenous	11,178	10,535	Kuwait 5,000; Belgium-Luxembourg 4,500; Lebanon 980.
Phosphatic	37,914	23,450	Kuwait 10,000; West Germany 5,118; Belgium-Luxembourg 4,419.
Ammonia	([1])	5	Mainly from France.
Graphite, natural	--	10	Mainly from Japan.
Lime	40	2,047	India 1,545; Belgium-Luxembourg 402; West Germany 100.
Mica, worked, including agglomerated splittings	1	--	
Pigments, mineral:			
Natural, crude	3,840	1,869	Turkey 1,064; West Germany 500; Spain 250.

See footnotes at end of table.

Table 3.—Iraq: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
NONMETALS —Continued			
Pigments, mineral —Continued			
Iron oxides, processed	1,009	251	United Kingdom 131; Japan 62; West Germany 39.
Precious and semiprecious stones, except diamond, natural ... carats	10,000	--	
Pyrite, gross weight	--	1,100	All from India.
Salt and brines	90	50	All from United Kingdom.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	15,080	16,005	Italy 10,196; United States 1,103; West Germany 1,009.
Caustic potash and sodic and potassic peroxides	--	5	All from Japan.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	3,117	1,796	Jordan 1,285; Italy 511.
Other	6,000	3,393	Jordan 3,360; Belgium-Luxembourg 33.
Worked	(1)	38	United Kingdom 35; West Germany 3.
Gravel and crushed rock	(1)	20	All from West Germany.
Limestone (except dimension)	100	359	Belgium-Luxembourg 197; Pakistan 162.
Sand, excluding metal bearing	71	300	Australia 150; Turkey 100; Syria 40.
Sulfur:			
Elemental:			
Other than collidal	41	20	United Kingdom 18; West Germany 2.
Colloidal	(1)	3	All from United States.
Sulfur dioxide	9	--	
Sulfuric acid	1,034	14	West Germany 7; United States 7.
Talc, steatite, soapstone, pyrophyllite	16	407	All from China, mainland.
Other:			
Oxides and hydroxides of magnesium, strontium, barium	204	3	West Germany 2; Denmark 1.
Bromine, iodine, fluorine	40	4	Mainly from West Germany.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	32,469	16,284	Greece 5,014; India 4,612; Lebanon 3,435.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	909	11	All from West Germany.
Carbon black	475	228	Italy 120; Sweden 60; India 30.
Coal: Briquets of anthracite and bituminous coal	309	500	All from Turkey.
Coke and semicoke	513	1,043	West Germany 657; Japan 315; Belgium-Luxembourg 57.
Gas, hydrocarbon:			
Natural ... kilograms	5	--	
Manufactured ... do	9,299	1	Mainly from United States.
Hydrogen, helium, rare gases	12	23	United Kingdom 18; United States 3; Kuwait 1.
Petroleum refinery products:			
Gasoline ... 42-gallon barrels	4,164	--	
Paraffin oil ... do	--	14	All from Belgium-Luxembourg.
Diesel oil ... do	22	--	
Lubricants ... do	4,170	31,386	Italy 22,512; West Germany 3,422; Greece 3,310.
Mineral jelly and wax ... do	667	630	Belgium-Luxembourg 155; Denmark 153; West Germany 144.
Other:			
Nonlubricating oils, n.e.s ... do	11	93	United Kingdom 15; Romania 10; Turkey 7.
Pitch ... do	28	307	All from U.S.S.R.
Petroleum coke ... do	4	--	
Bitumen and other residues ... do	6,999	--	
Bituminous mixtures, n.e.s ... do	143,134	37,456	France 16,983; United States 11,895; United Kingdom 5,315.

NA Not available.

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Iron and Steel.—Testing of new steelmaking facilities at Khor al Zubair began in two of four 70-ton arc furnaces in March 1978. The new steelworks, rated at 400,000 tons per year, had two six-strand continuous billet casters, and two rolling mills for the production of wire rods, rounds and sections. Initially domestic scrap was used for feed.

Creusot-Loire of France was concluding the construction of two HyL direct-reduction modules adjacent to the steel mill that

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were designed to produce 440,000 and 750,000 tons per year of sponge iron. Iron ore was imported and natural gas for the South Rumaila oilfield was used as a reductant. When in full production, sponge iron above the steel mill's need was to be exported. Iraqi steel imports in both 1978 and 1979 were estimated at 800,000 tons of milled steel products (for example, rod, bar, angles, and shapes) and 250,000 tons of pipes. Iraq operated a 30,000-ton-per-year pipemaking facility at Umm Qasr that utilized imported steel.

NONMETALS

Cement.—The Iraqi cement industry grew significantly in output and capacity in 1978 and 1979. The most notable addition was a four-kiln, 2-million-ton-per-year complex at al Kufah that was commissioned in 1978. Two 1,500-ton-per-day dry-process units were added to the Badosh cement works near Mosul. Additionally, in June 1978, a 100,000-ton-per-year white cement plant was commissioned at Falluja. Iraq's cement capacity has increased from approximately 3 million tons per year in 1976 to over 7 million tons per year in 1979.

Fertilizer Materials.—*Nitrogenous.*—In October 1979, Mitsubishi Heavy Industries of Japan completed a 2,000-ton-per-day ammonia, 3,200-ton-per-day Urea fertilizer complex at Khor al Zubair in southern Iraq near Umm Qasr. The complex trebled the nation's existing capacity. The complex consisted of two 1,000-ton-per-day Haldor Topse process ammonia units and two 1,600-ton-per-day Snamprogetti urea process plants. Natural gas from the south Rumaila/Zubair oilfields was used as feed stock for the new complex.

Phosphorous.—Syndicate Belge d'Enterprises a l'Etrange (Sybetra) of Belgium experienced significant delays in the building of a new phosphate mine and fertilizer complex in northern Iraq. All phases of a 3.4-million-ton-per-year open-cast mining operation and a 1-million-ton-per-year fertilizer complex were scheduled to be in operation late in 1980, but because of the lack of transport facilities and other factors, Iraq will not be a phosphate producer until late 1982 or early 1983.

Salt.—Early in 1978 the Government awarded a $46 million contract to Ingeco Laing International of Switzerland for the construction of a salt production complex near Fao in southern Iraq. Under a separate $20 million, 1978 contract, Wakachiku Construction Co. of Japan was to build the evaporation ponds, sea water channels, and access roads. The project, supplied on a turnkey basis, was slated for completion in 1981 and was to produce 525,000 tons per year of industrial salt and 75,000 tons per year of packaged table salt. All of the output from the project was to be consumed by the domestic market.

MINERAL FUELS

Natural Gas.—Iraq continued to flare more than 75% of the natural gas that it produced in association with crude petroleum in 1978 and 1979. Natural gas was utilized to power pumping stations on crude oil pipelines, in the production of fertilizers, in thermal power stations, and by some cement plants. Following the recommendations of studies commissiond in 1976, Iraq in 1978 and 1979 awarded contracts for large-scale gas-gathering and liquids-producing systems in both the northern and southern oilfield regions.

The northern project, based on associated gas from the Kirkuk, Bay Hasan, and Jambur oilfields, was to provide the domestic market with 1.2 million tons per year of condensate based on a natural gas throughput of 540 million cubic feet per day. Dry gas was to be utilized by major population centers in nothern Iraq including Baghdad. The project included 700 kilometers of pipelines, eight compressor stations, a processing plant at Kirkuk, storage tanks for liquids, and ancilliary faclities. The processing plant was also to recover 420,000 tons of sulfur annually. The northern project was slated to be completed in 1983.

The southern project will handle nearly 1.6 billion cubic feet per day from the Rumaila/Zubair oilfields which will release 6 million tons per year of liquids for fractionation. The southern project processing complex was to be at Khor al Zubair where export facilities, capable of handling vessels of up to 60,000 deadweight tons, were under construction. The project envisions the export of nearly 3.6 million tons per year of propane and butane. Ethane will be supplied to the Basrah petrochemical complex, natural gasoline will be recovered for local use, and the dry gas will be utilized by fertilizer plants, thermal power stations, and the new steel mill.

Petroleum.—Iraqi crude oil production increased significantly in 1978 and 1979 as expansion and development projects reached maturity. Crude oil output, which averaged 2.4 million in barrels per day in the first half of 1978, rose to 2.8 million in the second half of 1978 with production in December 1978 averaging over 3 million barrels per day; by April 1979 production was averaging nearly 3.4 million barrels per day, and by late 1979, daily production frequently topped 3.7 million barrels with a single day hitting the 4-million mark. Total Iraqi production of crude oil in 1979 breached the billion-barrel mark for the first time in 1979.

Oilfield developments expanded the Kirkuk oilfield capacity to 1.5 million barrels per day, the Bay Hasan and Jambur oilfields from 70,000 to 300,000 barrels per day, the Buzurgan—Abu Ghuraib—Jebal Fowgi group of fields to 200,000 barrels per day, and the Rumaila north oilfield to 860,000 barrels per day. The 50,600-barrel-per-day Luhais oilfield development program was completed in 1978. In 1979, Iraq announced plans to develop the Majnun oilfield, which was discovered in 1976 by Petrobras Internacional S/A (Braspetro). Production from the Majnun oilfield was to begin in 1983 with an initial rate of 350,000 barrels per day and subsequently be increased to 700,000 barrels per day. Majnun reserves have been estimated at 7 billion barrels, significantly higher than Braspetro's initial estimate of 1 to 2 billion barrels reported in 1976. Information concerning new oil discoveries in Iraq since 1975 has been scant in substantive content. The Government has on several occasions reported new important finds, but has not reported locations or estimates on the magnitude of the discoveries. Iraq reports crude oil reserves of 75 billion barrels; industry sources report estimates ranging from 32 to 34 billion barrels.

During 1979, capacity of the Basrah oil refinery was doubled to 140,000 barrels per day. A second 10,000-barrel-per-day topping plant was completed at Baiji near the K-2 pumping station, and a similar 10,000 barrel per day topping plant at al Samawah was brought to full production.

Construction on a 70,000-barrel-per-day refining facility at Baiji got underway in 1979. Engineering services for the $400 million project were to be provided by Snamprogetti S.p.A. of Italy under an April 1978 contract, and the Czechoslavakian state agencies Technoexport and Chemoproject initiated construction under a November 1978 contract. Start up was scheduled for April 1981. In October 1979, Mitsubishi Corporation and Chiyoda Chemical Engineering and Construction Co. Ltd. of Japan won a $307 million contract to supply the Iraqi State Organization for Oil Projects plant equipment for the 150,000-barrel-per-day second phase of the Baiji oil refinery complex. Commissioning of the second phase was scheduled for March 1983. Crude oil for the new major refinery was to be supplied from the Kirkuk oilfield through a new 66-centimeter (26 inch), 87-kilometer-long pipeline. The Baiji refining complex was to be connected to the Durah refining center near Baghdad to depot facilities near Mosal by dual 20-centimeter (8 inch), 400-kilometer-long product pipelines.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Iraqi dinars (ID) to U.S. dollars at the rate of ID1=US$3.3862.

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The Mineral Industry of Ireland

By William F. Keyes[1]

Ireland completed a second year of impressive economic growth in 1978, but the economy weakened in 1979. Real growth in the economy was about 6% in 1978 but fell to about 3.5% in 1979, as inflation jumped from 8% to 13% annually. Unemployment declined to 7.3% late in 1979, but labor relations disturbed the otherwise fairly favorable picture. Minerals producers were among those severely affected by the labor unrest. Two lead-zinc mines were shut down by strikes in 1978 and 1979, and natural gas production was hampered by lack of labor discipline.

Ireland is a major producer of zinc and lead on the world market, and it produces and exports important amounts of barite; other mineral production is chiefly of domestic importance. A quarter of the country's electricity is generated with domestic peat, and production of natural gas started in 1978. Exploration was active during 1978-79 especially for base metals in the Central Plain. However, after the tightening of licensing regulations in 1976, along with the general lack of concrete results in exploration in recent years, a feeling of caution was developing in the industry. With most outcrops already examined, the difficulty of probing the extensive glacial drift cover of the Central Plain, consisting of peat bogs and layers of silt, till, and sand and gravel, together with the need for deep overburden sampling, was inevitably increasing costs and making prospects less bright than a few years ago.

PRODUCTION

Ireland produced 3% of the world's mine zinc in 1978 and 1979 and about 1.4% of the world's lead. It also produced close to 6% of world barite. The only other mineral mined in large quantities was peat, which was almost all consumed domestically, largely for electricity production. Cement and petroleum products were produced for the domestic market, and there was a small production of copper, and, starting in 1978, of natural gas. Production of minerals in 1977, 1978, and 1979 is given in table 1.

Table 1.—Ireland: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978^{p}	1979^{e}
METALS				
Copper, mine output, metal content .... tons	^{r}4,100	4,900	4,800	4,100
Lead, mine output, metal content .... do	^{r}52,600	41,000	47,800	70,000
Iron and steel: Crude steel	^{r}88	47	69	72
Silver, mine output, metal content ... thousand troy ounces	925	936	631	600
Zinc, mine output, metal content .... tons	^{r}62,800	116,300	176,000	212,300
NONMETALS				
Barite .... do	323,000	373,000	349,000	360,000
Cement, hydraulic	1,569	1,580	1,806	2,000

See footnotes at end of table.

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Table 1.—Ireland: Production of mineral commodities —Continued

(Thousand metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Gypsum	355	342	392	400
Lime	69	80	92	90
Nitrogen, N content of ammonia	35	28	24	100
Pyrite	65	47	43	45
Sand and gravel[2]	5,770	5,464	5,726	[3]7,100
Stone: Limestone[2]	7,292	8,755	11,147	[3]11,101
Sulfur, S content of pyrite	31	22	20	20
Other[2] [4]	2,829	3,068	3,396	[3]4,200
MINERAL FUELS AND RELATED MATERIALS				
Coal: Anthracite and bituminous coal	49	54	31	[3]40
Coke, gashouse, including breeze	33	[e]33	NA	[3]41
Peat:				
For agricultural use	71	83	82	80
For fuel use:				
Briquets	308	351	334	
Sod peat[5]	1,834	2,015	1,974	5,000
Milled peat[6]	3,813	3,085	2,630	
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	3,528	4,219	4,508	[3]4,412
Jet fuel do	160	606	98	[3]252
Distillate fuel oil do	3,812	4,585	4,821	[3]4,596
Residual fuel oil do	5,714	6,622	6,388	[3]7,075
Other:				
Liquefied petroleum gas do	[r]602	695	719	[3]280
Naphtha do	[r]216	207	121	[3]136
Refinery fuel and losses do	[r]341	263	206	[3]574
Total do	[r]14,373	17,197	16,861	[3]17,305

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, substantial quantities of stone and sand and gravel are produced by local authorities for such purposes as road maintenance, but data are not reported and available general information is inadequate to make reliable estimates of output levels.

[2] Excludes output by local authorities.

[3] Reported figure.

[4] Figures given as reported in source; includes granite, marble, silica rock, sand, calcspar, fire clay, and slate and clays for cement production.

[5] Includes production by farmers and by Bord Na Mona.

[6] Includes milled peat used in the production of peat briquets, listed separately in this table.

TRADE

Ireland's chief source of metal and mineral products is the United Kingdom; much of its exports of nonferrous metal concentrates goes to smelters on the European Continent. Minerals exports and imports are shown respectively in tables 2 and 3. U.S. minerals exports to Ireland consist largely of nonferrous metals and iron and steel semimanufactures. U.S. mineral imports from Ireland are largely nonmetallics, such as barite and manufactured industrial diamonds.

Table 2.—Ireland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum metal including alloys, unwrought and semimanufactures	3,016	3,831	United Kingdom 2,968.
Copper:			
Ore and concentrate	18,985	25,002	Spain 18,083; West Germany 3,742.
Metal including alloys:			
Unwrought	652	359	Belgium-Luxembourg 127.
Semimanufactures	1,880	1,827	United Kingdom 931; United States 550.
Iron and steel:			
Roasted pyrite	31,092	NA	

See footnotes at end of table.

Table 2.—Ireland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Iron and steel —Continued			
Metal:			
Scrap	7,910	54,100	Spain 23,999; Denmark 7,720; West Germany 6,374.
Pig iron, ferroalloys, similar materials	62	115	NA.
Steel, primary forms	727	3,678	United Kingdom 3,499.
Semimanufactures	31,063	56,374	United Kingdom 43,190.
Lead:			
Ore and concentrate	71,886	69,175	France 24,899; Belgium-Luxembourg 16,239.
Metal including alloys, unwrought and semimanufactures	4,246	4,238	United Kingdom 4,182.
Nickel metal including alloys, unwrought and semimanufactures	219	151	Switzerland 54; West Germany 52.
Platinum-group metals and silver:			
Ores and concentrates	14	24	All to United Kingdom.
Metals including alloys, all forms:			
Platinum value	$668	$821	United Kingdom $819.
Silver do	$44	$167	NA.
Tin metal including alloys, unwrought	2	62	NA.
Zinc:			
Ore and concentrate	210,506	344,426	Belgium-Luxembourg 131,127; France 64,964.
Metal including alloys, unwrought and semimanufactures	406	377	NA.
Other metals including alloys, all forms	9,017	9,194	United Kingdom 2,079; West Germany 1,593.
NONMETALS			
Abrasives, natural	46	85	United States 17.
Asbestos	587	571	NA.
Cement	92,468	104,900	United Kingdom 101,981.
Clays and clay products (including all refractory brick):			
Crude	37,993	51,503	United States 44,927; United Kingdom 5,791.
Products:			
Refractory (including nonclay brick)	49,915	59,071	United Kingdom 17,491; West Germany 9,009; Poland 5,840.
Nonrefractory	1,484	1,400	NA.
Fertilizer materials:			
Crude:			
Phosphatic	--	5	NA.
Other	312	382	NA.
Manufactured:			
Nitrogenous	8,092	5,910	United Kingdom 5,560.
Phosphatic	124	1,081	NA.
Other	49,794	47,798	United Kingdom 46,456.
Gypsum and plasters	62,784	66,148	United Kingdom 32,210.
Lime	2,340	2,549	NA.
Mica, all forms	7,060	170	NA.
Pigments, mineral, including processed iron oxides	(1)	23	NA.
Salt	72	22	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	462	621	NA.
Worked	475	693	NA.
Gravel and crushed stone	357,247	295,172	West Germany 216,556.
Sand, excluding metal bearing	2,587	2,538	NA.
Other:			
Crude	323,627	322,853	United States 168,793; Algeria 24,242.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	20,719	18,809	Nigeria 7,996; United Kingdom 5,376.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	263	37	NA.
Coal, anthracite and bituminous	49,130	57,945	United Kingdom 54,877.
Coke and semicoke	30,773	25,948	All to Sweden.
Peat, including peat briquets and litter	155,906	158,116	United Kingdom 149,951.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	35	5	NA.
Kerosine do	4	(1)	NA.
Residual fuel oil do	975	192	Portugal 102; United Kingdom 57.

See footnotes at end of table.

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Table 2.—Ireland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum refinery products —Continued			
Lubricants thousand 42-gallon barrels	55	54	United Kingdom 32.
Other:			
Liquefied petroleum gas do	9	--	
Unspecified do	3	--	
Total do	1,081	251	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	263	128	NA.

NA Not available.
[1] Less than 1/2 unit.

Table 3.—Ireland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate	282	330	NA.
Oxide and hydroxide	3,142	3,067	United Kingdom 2,873.
Metal including alloys:			
Scrap	145	441	NA.
Unwrought	5,625	6,333	Norway 3,316; United Kingdom 2,188.
Semimanufactures	10,465	14,098	United Kingdom 6,388; United States 3,057.
Chromium:			
Chromite	6,445	NA	
Oxide and hydroxide	62	87	NA.
Cobalt oxide and hydroxide kilograms	600	1,200	NA.
Copper metal including alloys:			
Scrap	68	95	NA.
Unwrought	333	161	NA.
Semimanufactures	13,975	15,746	United Kingdom 12,126.
Iron and steel:			
Ore and concentrate	60	--	
Metal:			
Scrap	2,228	9,051	United Kingdom 5,485.
Pig iron, including cast iron	714	1,345	NA.
Sponge iron, powder, shot	856	964	NA.
Ferromanganese	544	990	NA.
Steel, primary forms	12,916	17,004	United Kingdom 12,248.
Semimanufactures:			
Bars, rods, angles, shapes, sections	139,158	143,594	United Kingdom 73,011; Belgium-Luxembourg 24,303; Spain 18,254.
Universals, plates, sheets	150,041	154,515	United Kingdom 73,795; France 20,022.
Hoop and strip	14,701	14,418	United Kingdom 10,086.
Rails and accessories	7,565	15,334	United Kingdom 8,974; West Germany 3,541.
Wire	15,752	11,139	United Kingdom 7,296.
Tubes, pipes, fittings	51,239	59,132	United Kingdom 29,780; Italy 6,729; India 4,892.
Castings and forgings, rough	3,680	3,068	United Kingdom 1,318; Italy 882; France 457.
Total	382,136	401,200	
Lead:			
Oxides	3,116	2,421	Mainly from United Kingdom.
Metal including alloys, all forms	3,139	5,012	United Kingdom 3,563.
Magnesium metal including alloys, all forms	136	NA	
Manganese:			
Ore and concentrate	26,039	37,120	Ghana 36,942.
Oxides	109	187	NA.
Mercury 76-pound flasks	96	954	NA.
Molybdenum metal including alloys, all forms	1	NA	
Nickel:			
Matte, speiss, similar materials	1	29	NA.

See footnotes at end of table.

Table 3.—Ireland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Nickel —Continued			
Metal including alloys:			
Scrap	--	2	NA.
Unwrought and semimanufactures	335	697	United Kingdom 234; West Germany 114; United States 90.
Platinum-group and silver metals including alloys:			
Platinum-group value, thousands	$1,350	$1,240	United Kingdom $1,236.
Silver do	$1,223	$1,480	United Kingdom $1,397.
Rare-earth metals including alloys	11	33	NA.
Tin:			
Oxides	82	NA	
Metal including alloys, unwrought and semimanufactures	102	108	United Kingdom 50.
Titanium oxides	3,677	3,644	United Kingdom 1,265; France 646.
Tungsten metal including alloys, all forms	6	NA	
Zinc:			
Oxides	927	929	United Kingdom 817.
Metal including alloys:			
Scrap	580	147	NA.
Unwrought	2,020	2,184	United Kingdom 1,494.
Semimanufactures	1,351	3,581	United Kingdom 2,929.
Other:			
Ores and concentrates	906	NA	
Ash and residue containing nonferrous metals	1,609	449	NA.
Oxides, hydroxides, pentoxides of metals	337	314	NA.
Base metals including alloys, all forms	398	NA	
NONMETALS			
Abrasives, natural:			
Crude, n.e.s	2,052	2,132	NA.
Grinding and polishing wheels and stones	549	629	United Kingdom 269; West Germany 162.
Asbestos	6,656	8,014	Cyprus 3,880; Republic of South Africa 2,397.
Barite and witherite	402	425	NA.
Boron materials:			
Crude natural borates	2,684	1,762	Netherlands 1,082; United States 680.
Oxide and acid	69	101	NA.
Cement	30,973	314,082	United Kingdom 121,046; Belgium-Luxembourg 54,443.
Chalk	6,935	8,197	United Kingdom 5,314.
Clays and clay products (including all refractory brick):			
Crude	31,503	36,854	United Kingdom 28,693.
Products:			
Refractory (including nonclay brick)	16,010	15,777	United Kingdom 10,587.
Nonrefractory	18,837	43,721	United Kingdom 35,739.
Diamond, all grades carats	(1)	60,000	NA.
Feldspar and fluorspar	6,227	6,165	NA.
Fertilizer materials:			
Crude:			
Phosphatic	120,995	104,728	Morocco 76,831; United States 21,566.
Potassic	--	10	NA.
Other	1,480	1,839	NA.
Manufactured:			
Nitrogenous	147,829	137,204	United Kingdom 38,694; Belgium-Luxembourg 22,734.
Phosphatic	129,534	154,982	United States 52,485; United Kingdom 37,852.
Potassic	279,153	334,022	West Germany 107,879; France 78,644.
Other	304,388	326,272	United Kingdom 221,473; United States 55,934.
Ammonia	122,156	107,565	Netherlands 106,796.
Graphite, natural	96	88	NA.
Gypsum and plasters	4,268	3,981	United Kingdom 2,589.
Lime	1,720	1,964	NA.
Magnesite	16,589	22,479	Greece 12,749; Spain 4,365.
Mica:			
Crude, including splittings and waste	202	594	NA.

See footnotes at end of table.

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Table 3.—Ireland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Mica —Continued			
Worked	--	31	NA.
Pigments, mineral:			
Natural, crude	156	NA	
Iron oxides, processed	1,388	1,535	West Germany 1,019.
Precious and semiprecious stones, excluding diamond value	$403	NA	
Salt	72,261	77,221	United Kingdom 59,845; West Germany 10,547.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	18,030	22,180	United Kingdom 19,072.
Caustic potash and sodic and potassic peroxides	748	583	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	1,562	2,123	Italy 1,874.
Slate	497	549	NA.
Other	1,622	6,333	Republic of South Africa 3,769.
Worked:			
Slate	722	937	France 563.
Paving stone and flagstone	--	32	NA.
Other	926	1,239	Italy 853.
Dolomite	1,955	944	NA.
Gravel and crushed stone	216,119	282,429	United Kingdom 278,694.
Limestone, except dimension	4,234	3,009	NA.
Quartz and quartzite	238	465	NA.
Sand, excluding metal bearing	98,012	126,676	United Kingdom 27,091; Belgium-Luxembourg 24,099.
Sulfur:			
Elemental:			
Colloidal	146	19	NA.
Other than colloidal	10,754	8,592	Canada 8,139.
Sulfur dioxide	3,988	7,544	United Kingdom 5,100.
Sulfuric acid	44,467	34,678	United Kingdom 33,501.
Talc, steatite, soapstone, pyrophyllite	1,951	1,988	United Kingdom 1,542.
Other:			
Crude	7,490	6,233	NA.
Slag, dross, and similar waste, not metal bearing	1,354	2,291	NA.
Oxides and hydroxides of magnesium, strontium, barium	20	23	NA.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	11,372	14,027	United Kingdom 12,764.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,515	3,004	United Kingdom 1,232.
Carbon black and gas carbon	18,721	11,468	United Kingdom 11,272.
Coal: Anthracite and bituminous coal thousand tons	868	839	Poland 600; United Kingdom 213.
Coke and semicoke do	35	5,437	United Kingdom 5,399.
Hydrogen and rare gases	2,590	3,356	United Kingdom 2,228.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	16,054	15,255	Iran 5,790; Saudi Arabia 5,616.
Refinery products:			
Gasoline do	4,842	5,825	United Kingdom 5,020.
Kerosine do	2,722	2,984	United Kingdom 2,947.
Distillate fuel oil do	4,708	5,357	United Kingdom 3,676; U.S.S.R. 1,257.
Residual fuel oil do	12,068	11,558	United Kingdom 6,875; U.S.S.R. 1,445; Italy 1,421.
Lubricants do	364	411	United Kingdom 393.
Other:			
Liquefied petroleum gas do	673	940	NA.
Mineral jelly and wax do	26	22	United Kingdom 15.
Nonlubricating oils, n.e.s do	609	NA	
Bitumen and other residues do	500	748	United Kingdom 722.

See footnotes at end of table.

Table 3.—Ireland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum —Continued			
Refinery products —Continued			
Other —Continued			
Bituminous mixtures, n.e.s ----- do ----	56	66	United Kingdom 65.
Pitch and pitch coke ---------- do ----	2	1	NA.
Total ------------------ do ----	26,570	27,412	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ------------------	4,998	5,597	United Kingdom 5,536.

NA Not available.
[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—Site preparation began in August 1978 for the new $500 million, 800,000-ton-per-year alumina plant on Aughinish Island, in the Shannon estuary near Foynes. By yearend 1979, cost estimates reached $700 million.

By late 1978, financing arrangements were completed by the controlling consortium, Aughinish Finance Ltd., members of which were Alcan Ireland Ltd. (40%), Anaconda Ireland Ltd. (25%), and Billiton Aluminium Ireland Ltd. (35%). Loan agreements totaled $308 million, of which $250 million was in the form of a Eurodollar loan provided by 16 international banks led by the Citicorp International Group, and $58 million was in Irish pounds contributed by a group of Irish banks led by the Bank of Ireland. United Kingdom export credits had been obtained in February 1978 totaling about $146 million.

The project on Aughinish Island was the largest and most costly ever undertaken in Ireland, and when completed in 1982 or 1983 will employ 800 persons. Unfortunately the construction work was plagued by a series of 16 work stoppages by the end of 1979. The bauxite to be processed in the plant was to come from Guinea (West Africa) and Brazil. The alumina product was to be exported to aluminum smelters in North America and the European Economic Community, of which Ireland is a member.

Iron and Steel.—Irish Steel Holdings (ISH), sole domestic producer, reached a preliminary accord in 1978 with Ste. Metallurgique de Normandie, a French producer, to exchange certain products. This would permit ISH to proceed on its modernization and expansion program at its plant near Cork without a net expansion within the European Economic Community (EEC), which would have infringed on EEC rules to limit capacity in the depressed market. Normandie agreed to close its 50,000-ton-per-year, 450-millimeter section mill and would sell on behalf of ISH 60,000 tons per year of merchant bars. ISH would in turn market 60,000 tons per year of wire rod from Normandie.

ISH's expansion plans would increase capacity to some 300,000 tons per year, twice the present level, with startup scheduled for June or July 1980; a three-strand continuous bloom caster and 90-ton arc furnace were to be purchased as part of the £40 million (about $80 million) expansion. The financing package approved by the Government for the expansion plus ancillary facilities totaled £60 million, including £17.5 million from the European Economic Community, £4 million from the Irish Development Authority, £10 million to £12 million from United Kingdom leasing facilities, equity financing of £10.5 million, and the balance from short-term loans from Irish banks.

Lead-Zinc.—Ireland's new major metal mine, Tara Mines, at Navan, suffered an estimated $12 million loss in 1978. Weak base metal prices, particularly that of zinc, affected profits in the first half, and there was a 6-week strike in the quarter. Full production at the scheduled rate of 400,000 tons of zinc concentrates and 70,000 tons of lead concentrates, from 2.3 million tons of ore, which was expected to be reached by the end of 1978, was delayed at least another 6 months. The resulting financial bind, amounting to a total indebtedness of about $170 million by mid-1979, caused Tara Mines to request rescheduling of its debt repayments to the Toronto Dominion Bank and the Export Development Corporation of Canada. Approval of the Irish Government,

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which owns 25% of Tara, was awaited as Tara continued to suffer a series of debilitating strikes.

The Tynagh mine in County Galway, which was operating unprofitably and was scheduled to be closed by 1980, was shut down twice during the period, also because of strikes. Employees objected to the terms of proposed severance benefits supplementing payments required by Irish law. About 350 employees were due to lose their jobs. The third active Irish lead-zinc mine, Silvermines, in County Tipperary, continued in expectation of closing in the early 1980's.

Activity continued at the two new mines slated for development near Tara Mines. A Government-sponsored study on diversion of the Blackwater River, which flows across the mining area, was completed late in 1978. Bula and Tara continued to disagree about sharing the £4 million cost of diverting the Blackwater to permit underground operations; the mines are only about a mile apart. Bula Ltd. also submitted to county authorities a new plan for surface and underground mining operations, replacing the one rejected in 1976. Some 1 million tons will be mined annually, yielding 150,000 tons of lead and zinc concentrates.

At the other property, Rennicks & Bennett, at Scallanstown, near Navan, reserves were reevaluated at 2 million tons grading 7% combined lead and zinc. Messina (Transvaal) Development Company Limited exercised its option to take a 47.5% interest in the mine. This action reduced the share of Sabina Industries Ltd. of Canada to 30.45% and that of two local companies, Glencar and Rennicks & Bennett, to 17% and 5%, respectively. Messina was still to make a feasibility study and was to assume 60% of any eventual development cost. An agreement to share the nearby Tara plant was being considered.

The Irish Government Industrial Development Authority decided to go ahead tentatively with the long-discussed zinc refinery in spite of the withdrawal of the New Jersey Zinc Company from the project in January 1978. A site at Ballylongford, County Kerry, on the south bank of the Shannon estuary, was chosen, and a search was instituted for partners to share the cost, which could reach $200 million. The proposal of the Soviet Government to build the plant was rejected, and a Government mission to Japan in September 1978 evoked a promise from Mitsui Mining and Smelting Co. Ltd. to study the plans. An electrolytic refinery was considered most likely.

NONMETALS

Barite.—Growth continued in Ireland's barite industry, already the largest in Western Europe. Milchem Inc. reopened the Lady's Well mine near Clonakilty, County Cork, in August 1979 after finishing an exploration and diamond drilling program started in 1976; a rate of 50,000 tons of barite per year was to be reached. The product will go to Milchem's grinding facilities on the U.S. gulf coast via rail to the port of Cork. The Glencarbury (Benbulbin) mine at Ballintrillick, County Sligo, was being operated by Imco. Inc. (Halliburton), and a second mine in the Benbulbin area of Sligo was also to be opened by Glencar Exploration Ltd.

Major barite production in Ireland continued to come from the Silvermines (Ballynoe) deposit of Dresser Minerals (Magcobar) in Tipperary, which has a capacity of 290,000 tons per year; and from the Tynagh lead-zinc mine in Galway, where Milchem has a flotation plant with a capacity to recover about 60,000 tons per year of barite from the tailings pond.

Nitrogen.—The 366,000-ton-per-year (nitrogen content) ammonia plant, built by Nitrigin Eireann Teoranta at Marino Point in Cork Harbor, came onstream early in 1979. A urea plant with a capacity of 142,000 tons per year (nitrogen content) followed shortly thereafter. Although domestic consumption of nitrogen in fertilisers was rising rapidly, it still was well below the plant capacity, and a substantial surplus for export was expected to be available.

MINERAL FUELS

Natural Gas.—The first flow of natural gas from the Kinsale offshore field reached the landfall at Inch Bay, southeast of Cork, in October 1978, some 6 months ahead of the original schedule. The accelerated completion was a result of finishing the two production platforms in one season, at the insistence of the Government. Officials of Marathon Petroleum Ireland Ltd., the operator, announced publicly their request for additional recompense for the costs of this acceleration. At the same time they expressed regret at the lack of discipline and excessive demands made by the labor union, the Irish Transport and General Workers Union.

Petroleum.—After a record 15 wildcat wells drilled offshore in 1978, the first significant, but still noncommercial, find was made by a group comprising Phillips (the operator), Getty, Amerada-Hess, and Century Power and Light, in the Porcupine Basin, some 110 miles west of the Shannon estuary. The find had a flow of 730 barrels per day of good-quality low-sulfur crude but was made in very deep water (1,411 feet).

British Petroleum Development Ltd. also announced, in mid-1979, that it had encountered oil flows from three separate sands on Block 26/28 offshore about 1,120 miles west of Galway, also in the Porcupine Basin. The flows were not economic and were in more than 1,200 feet of water, but a decision was to be made whether to explore further in the same area.

Three major question marks faced the Irish Government if the oil exploration attained some degree of success: One was the question of the boundaries of the national jurisdiction, since the line between Ireland and the United Kingdom continued to be in dispute; second was the possible construction of a new refinery, as the sole existing refinery provided only 40% of domestic requirements (capacity was about 56,000 barrels per day) and was over 20 years old; a third major issue would be the possible formation of a national oil company. In July 1979, the Government announced the formation of a national oil company, and early in 1980, the British Government accepted an Irish proposal for arbitration of their mutual boundaries, but progress was expected to be slow.

Uranium.—Four areas in the Republic were the principal sites of searches for uranium. In 1978, the most advanced work was that undertaken by Maugh Ltd., a subsidiary of the French Government company Minatome. Maugh received 27 uranium-only licenses for an area in the Leinster Granites of the southeast; the most significant anomaly found was at Tullow, County Carlow. In the general area Irish Base Metals Ltd. (IBM), subsidiary of Northgate Exploration of Canada, focused on a site near Thomaston after Hunting Geology and Geophysics Ltd., which had the year before conducted an airborne spectrometer survey for Aquitaine Mining Ireland Ltd., completed a similar survey for IBM and its partner, Tara Prospecting Ltd. Munster Base Metals, a wholly owned subsidiary of Anglo United Development Corp., a Canadian company, held licenses in the Fintown area of County Donegal, where a significant radiometric anomaly was located; trenching and a bedrock channel sampling program were underway, and drilling started in 1979 with six shallow holes; results ranged from 0.32 pound per short ton over 11 feet to 112.2 pounds per short ton over 24.9 feet. Another Canadian company, Argosy Mining Corporation of Toronto, carried out geochemical and scintillometer surveys at Allihies, in the far southwest of County Kerry. Maugh, Irish Base Metals, and also the Geological Survey of Ireland received grants from the EEC under the EEC's Euratom program.

In mid-1978, the Government issued a Green Paper in which it saw little alternative to building at least one nuclear reactor. In view of expected major growth in energy use (estimated at 7% for several years and 5% thereafter), dependence on imported oil could become dangerous, and one 300-megawatt power station was being planned, to use coal but with provision to convert to oil if the search for offshore oil should be successful. The 650-megawatt nuclear reactor planned for Carnsore Point for 1987-88 was also a necessity because it would permit stockpiling several years' supply of fuel. Several protests were organized against building the Carnsore Point plant, particularly after reports were received of the Three Mile Island failure in the United States.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Average exchange rate in 1978 and 1979 was £1.0=US$2.00.

The Mineral Industry of Israel

By David E. Morse[1]

Israel's mineral industry continued to provide a small but important contribution to the nation's economy in 1978 and 1979. Water from the Dead Sea was processed to produce potash, elemental bromine, magnesium oxide, and salts of sodium and magnesium. Israel's mines and quarries produced phosphate rock, dolomite, limestone, marble, gypsum, clays, glass sand, dimension and crushed stone, and sand and gravel. Israel had three cement plants, two oil refineries, and an active chemical industry based on raw materials produced from domestic sources. Oil exploration remained active, and crude output increased substantially as the Alma field in the Gulf of Suez began production in April 1978. Israel's diamond-polishing industry continued to be significant in the world market, with net sales over $1 billion in 1978 and 1979.

The Israeli economy resumed significant growth in 1978. After 3 years of relative economic stagnation, the gross national product (GNP) increased by over 5% in real terms in both 1978 and 1979. The unemployment rate dropped from 3.9% in 1977 to 3.2% in 1979, and a significant number of workers from the West Bank were enrolled into the Israeli work force. Worker productivity, which had shown little change in the 1974-77 period, rose by an impressive 6% in 1979. The number of employed persons reached an alltime high of over 1.28 million by yearend 1979. These economic gains were accompanied, however, by a continuing high inflation rate; the consumer price index escalated by more than 50% in 1978 and by nearly 100% in 1979.

In March 1979, after holding lengthy negotiations and receiving aid in the form of incentives from the United States, Israel and Egypt signed a peace treaty. The United States agreed to aid in building facilities in Israel for the redeployment of Israeli forces from the Sinai Peninsula. In 1979, several areas of the Sinai were returned to Egyptian control, including the Alma oilfield, which was renamed Shab Ali.

Expansion of the phosphate terminal at Ashdod was completed in late 1979, bringing the handling capacity of the port to 4 million tons per year. The Israeli rail system was being expanded, and main lines to connect the present system to Sdom on the Dead Sea and to the port of Eilat on the Gulf of Agaba were slated for completion in 1983.

Israeli scientists at Technion Institute at Haifa conducted laser beam experiments designed to extract liquid and gaseous hydrocarbons from Israel's oil shales. Oil shale resources in the Negev Desert south of Arad have been estimated at 2 billion tons. Israel also continued experiments to find ways to expand the use of solar energy.

PRODUCTION

Israel's mineral sector supplied most of the domestic needs for industrial minerals and fertilizers but did not meet domestic requirements for metals and fuels. Products from the Dead Sea and phosphate rock were important export commodities. Phosphate rock, bromine, and bromine compounds showed significant production increases in 1978 and 1979 as new facilities were brought to full production. Production of most mineral commodities remained quite stable at or near the capacity of existing facilities.

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Table 1.—Israel: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Iron and steel:[e]				
Pig iron	40,000	40,000	40,000	40,000
Crude steel	[r]80,000	100,000	100,000	90,000
NONMETALS				
Bromine:				
Elemental	20,900	31,500	34,550	45,300
Compounds	10,300	20,350	23,550	40,000
Cement, hydraulic ... thousand tons	1,999	1,964	1,996	[2]1,900
Clays:				
Flint clay	70,000	30,500	33,656	40,000
Metabentonite	15,000	8,000	6,952	8,100
Kaolin	10,000	5,500	6,350	7,200
Other	4,000	1,000	11,450	8,000
Gypsum	200,000	200,000	200,000	200,000
Lime	200,000	102,000	124,000	118,000
Nitrogen: N content of ammonia	[e]64,000	68,500	67,700	68,000
Phosphate rock, beneficiated ... thousand tons	639	1,227	1,725	2,100
Potash, K_2O equivalent ... do	680	707	732	725
Salt, marketed (mainly marine)	86,561	[e]100,000	121,560	127,000
Sand:				
Glass sand	84,000	83,500	86,864	85,000
Other (for building industry) ... thousand cubic meters	4,500	4,963	3,705	4,000
Sodium and potassium compounds: Caustic soda	24,009	26,836	21,626	24,500
Stone:				
Dimension, marble	16,000	22,000	[e]24,000	24,000
Crushed ... thousand cubic meters	13,000	NA	NA	NA
Sulfur:				
Byproduct from petroleum	10,000	10,000	10,000	10,000
Sulfuric acid ... thousand tons	208	198	183	195
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural, marketed ... million cubic feet	2,055	2,010	2,016	2,000
Peat[e] ... thousand tons	20	20	20	18
Petroleum:				
Crude:				
From Israel proper ... thousand 42-gallon barrels	262	198	177	181
From occupied Sinai Peninsula ... do	6	--	6,200	10,000
Refinery products:				
Gasoline ... do	7,999	6,375	6,515	6,700
Jet fuel ... do	4,521	5,619	5,863	5,900
Kerosine ... do	1,893			
Distillate fuel oil ... do	13,136	8,012	6,555	7,000
Residual fuel oil ... do	20,014	28,944	31,594	30,000
Lubricants ... do	262	NA	NA	NA
Other ... do	3,371	2,838	2,565	2,500
Refinery fuel and losses ... do	2,133	2,158	1,050	2,200
Total ... do	53,329	53,946	53,942	54,000

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, Israel reportedly has the capacity to produce 71 tons of U_3O_8 per year, but official data are not reported and available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

TRADE

The value of Israel's mineral exports grew significantly in 1978 and 1979. Major mineral exports included phosphate rock, potash, bromine, bromine compounds, calcined and sintered magnesia, and manufactured fertilizers. Mineral industry exports, excluding petroleum and petroleum products, were valued at over $150 million[3] in 1979.

The Israeli diamond industry continued to be a significant factor in the value of Israel's total trade. Exports of polished diamond totaled $1.3 billion in 1978 and were estimated at $1 billion in 1979. Imports of rough stones were valued at $1.03 billion in 1978 and were estimated at $850 million in 1979. Major importers of polished diamond from Israel were the United States, Hong Kong, Japan, Belgium-Luxembourg, the Netherlands, Switzerland, and the Federal Republic of Germany.

Israel's materials trade balance continued to be highly unfavorable despite a 25% increase in the value of exports in 1978 and an increase of nearly 16% in 1979. Excluding defense imports, increased imports of consumer goods and the significant increase in the cost of crude petroleum on the world market contributed significantly to the trade deficit of nearly $2.45 billion in 1979. The cost of imported fuels and lubricants increased slightly (3%) in 1978 to $775 million but changed dramatically in 1979 as Israel was forced to buy more crude oil on the spot market. Petroleum imports in 1979 were over $1.2 billion.

Table 2.—Israel: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977[1]	1978[1]	Principal destinations, 1978
METALS			
Aluminum metal including alloys, all forms[2]	^{r}15,430	16,910	France 5,734; United Kingdom 2,037; West Germany 1,111; Iran 1,056.
Copper:			
Copper cement — value, thousands	$122	$39	Singapore $33.
Matte[3]	^{r}428	148	Switzerland 135.
Metal including alloys:			
Scrap	2,648	2,223	Belgium-Luxembourg 1,420; Spain 310; Switzerland 262.
Unwrought and semimanufactures[4]	2,061	3,674	United States 2,488; Netherlands 693.
Iron and steel:			
Iron pyrites	12	--	
Metal including alloys, all forms[5]	17,187	26,136	United States 18,415; West Germany 2,771; Republic of South Africa 767.
Lead metal including alloys, all forms	225	372	Netherlands 244; West Germany 93.
Nickel metal including alloys, all forms	72	48	United Kingdom 21; United States 15; West Germany 10.
Zinc metal including alloys, all forms	[6]563	1,293	Republic of South Africa 558; Spain 308; Italy 194.
Other:			
Ash and residue containing nonferrous metals[7]	357	527	Spain 268; Austria 94; United Kingdom 51.
Metals including alloys, all forms[8] — value, thousands	^{r}$2,119	$1,600	United Kingdom $658; United States $470; West Germany $87.
NONMETALS			
Abrasives, natural, n.e.s.: Grinding and polishing wheels and stones — value	$393,000	$524,000	United States $248,000; Australia $70,000; Canada $67,000.
Barite and witherite	761	708	Republic of South Africa 690.
Bromine[9]	NA	NA	
Clays and clay products (including all refractory brick):			
Crude[10]	5,848	12,356	Netherlands 6,301; Greece 3,546.
Products:			
Refractory (including nonclay bricks)[11]	1,941	3,088	West Germany 1,173; Greece 711.
Nonrefractory — value	^{r}$481,000	$501,000	Australia $296,000; Tanzania $96,000.
Diamond, gem, not set or strung[12] — thousand carats	3,637	2,884	United States 962; Hong Kong 462; Belgium-Luxembourg 342.
Fertilizer materials:			
Crude:[13]			
Phosphatic	479,708	479,401	Italy 134,744; Austria 75,794; Belgium-Luxembourg 65,777.
Other	322	5,764	Belgium-Luxembourg 5,160.
Manufactured:			
Nitrogenous[14]	^{r}9	468	Spain 300; Republic of South Africa 58; Iran 56.
Phosphatic[15]	^{r}193,906	626,602	France 174,752; Italy 89,562; Netherlands 81,462; West Germany 80,120.
Potassic — value, thousands	$779	$978	Greece $535; Republic of South Africa $248.
Other, including mixed[16]	668,495	267,221	United States 66,791; Italy 36,751; Republic of South Africa 34,628.
Lime	770	336	Ethiopia 269; Ivory Coast 67.
Magnesite	24,384	[17]20,948	Austria 15,164; West Germany 4,737; United Kingdom 1,040.
Precious and semiprecious stones, except diamond — value, thousands	$10,997	$21,640	United States $9,430; Switzerland $4,842; West Germany $1,710.
Salt	94	3,136	Kenya 2,500; Cyprus 393.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	[18]1,500	--	
Stone, sand and gravel, all types[19]	^{r}1,772	2,750	West Germany 1,478; Greece 1,029.
Sulfur:			
Elemental, all forms — value	^{r}$34,000	$10,000	United States $10,000.
Sulfuric acid	331	269	Ethiopia 232; Ivory Coast 37.
Other:			
Crude[8] — value, thousands	$304	$2,512	Austria $984; United Kingdom $711; West Germany $653.
Bromine, chlorine, fluorine, iodine	12,342	NA	
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s.[20]	^{r}1,117	608	Nigeria 274; Cyprus 141; Mauritius 137.

See footnotes at end of table.

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Table 2.—Israel: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity		1977[1]	1978[1]	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS				
Carbon black		738	782	Kenya 452; Ethiopia 209.
Hydrogen, helium, rare gases	value	[r]$3,000	$76,000	United Kingdom $71,000.
Petroleum refinery products:				
Gasoline	thousand 42-gallon barrels	--	NA	
Kerosine	do	--	NA	
Jet fuel	do	--	NA	
Distillate fuel oil	do	--	NA	
Lubricants	do	1	NA	
Other	do	9	NA	
Total	do	10	NA	

[e]Estimate. [r]Revised. NA Not available.

[1] Figures may be incomplete; unless otherwise specified, the figures given are the sums of listed detail for all countries for which a quantity figure is provided in official Israeli trade returns. Additional quantities may have been exported to other countries for which only a value figure is provided. In some cases, where it is clear that a significant portion was exported for which no quantity figure was provided, the value figure has been given in a footnote.

[2] Totals exclude quantities valued at $632,000 in 1977 and $1,572,000 in 1978.

[3] Totals exclude quantities valued at $37,000 in 1977 and $3,000 in 1978.

[4] Totals exclude quantities valued at $85,000 in 1977 and $91,000 in 1978.

[5] Totals exclude quantities valued at $351,000 in 1977 and $448,000 in 1978.

[6] Total excludes quantity valued at $29,000.

[7] Totals exclude quantities valued at $16,000 in 1977 and $24,000 in 1978.

[8] Table 3 provides additional detail on these categories.

[9] Elemental bromine is included with chlorine, fluorine, and iodine in the source and is reported in this grouping under "Other" nonmetals in this table.

[10] Totals exclude quantities valued at $87,000 in 1977 and $114,000 in 1978.

[11] Totals exclude quantities valued at $68,000 in 1977 and $5,000 in 1978.

[12] Totals exclude quantities valued at $490,000 in 1977 and $408,000 in 1978.

[13] Totals exclude quantities valued at $13,000 in 1977 and $237,000 in 1978.

[14] Totals exclude quantities valued at $231,000 in 1977 and $2,169,000 in 1978.

[15] Totals exclude quantities valued at $1,184,000 in 1977 and $540,000 in 1978.

[16] Totals exclude quantities valued at $429,000 in 1977 and $4,010,000 in 1978.

[17] Total excludes quantity valued at $272,000.

[18] Total excludes quantity valued at $42,000.

[19] Totals exclude quantities valued at $98,000 in 1977 and $8,000 in 1978.

[20] Totals exclude quantities valued at $887,000 in 1977 and $291,000 in 1978.

Table 3.—Israel: Exports of other metals and nonmetals

(Value, thousands—total)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Gold	$41	$233	United Kingdom $206; Switzerland $15; United States $12.
Magnesium	7	41	United Kingdom 33; Netherlands 8.
Silver	7	64	West Germany 64.
Tin	302	12	United Kingdom 9; Netherlands 3.
Tungsten	1,496	1,021	United Kingdom 410; Italy 303; United States 252.
Other base metals	266	229	United States 206; West Germany 23.
Total	[r]2,119	1,600	
NONMETALS			
Cement, white	73	6	Tanzania 6.
Oxides and hydroxides of barium and magnesium	217	2,506	Austria 984; United Kingdom 711; West Germany 653.
Other	14	--	
Total	304	2,512	

[r]Revised.

Table 4.—Israel: Imports of mineral commodities

Commodity	Quantity (metric tons unless otherwise specified)		Value, thousands			
	1977[1]	1978	Of reported quantity		Of additional unreported quantity	
			1977[1]	1978	1977[1]	1978
METALS						
Aluminum:						
Bauxite and concentrate	18	806	$3	$229	$259	$102
Oxide and hydroxide	608	489	640	805	46	64
Metal including alloys, all forms	24,858	33,543	45,248	52,959	2,788	12,559
Cadmium metal including alloys, all forms	NA	2	NA	12	105	46
Chromium oxide, hydroxide, trioxide	NA	NA	NA	NA	109	187
Copper metal including alloys, all forms	14,869	16,998	28,069	38,548	3,049	2,438
Gold metal, unworked or partly worked troy ounces	NA	NA	NA	NA	24,571	56,260
Iron and steel metal:						
Scrap	NA	NA	NA	NA	27	1,153
Pig iron, ferroalloys, similar materials	1,818	1,885	1,284	1,685	1,047	549
Steel, primary forms	19,239	64,247	6,975	16,473	494	1,789
Semimanufactures:						
Bars, rods, angles, shapes, sections	4,219	3,803	10,372	14,679	116	585
Universals, plates, sheets	1,247	866	7,398	8,603	1,969	3,220
Hoop and strip	1,781	3,244	5,140	8,103	1,709	1,181
Rails and accessories	999	47	660	253	107	374
Wire	3,131	8,108	8,983	10,778	1,558	1,172
Tubes, pipes, fittings	4,607	4,701	12,712	14,758	2,614	4,824
Lead:						
Oxides	730	649	952	860	33	25
Metal including alloys, all forms	1,564	2,945	1,755	2,401	135	60
Magnesium metal including alloys, all forms	26	27	356	159	755	1,236
Manganese oxides	NA	NA	NA	NA	117	310
Mercury 76-pound flasks	NA	87	NA	28	44	10
Molybdenum metal including alloys, all forms	NA	NA	NA	NA	48	293
Nickel metal including alloys, all forms	145	100	1,514	1,640	913	869
Platinum-group metals including alloys, all forms troy ounces	NA	NA	NA	NA	493	741
Silver metal including alloys, all forms do	NA	NA	NA	NA	2,942	5,774
Tin:						
Oxides	NA	NA	NA	NA	39	--
Metal including alloys, all forms	6	19	449	1,239	583	287
Titanium oxides	37	127	1,549	1,955	690	1,076
Tungsten metal including alloys, all forms	8	67	51	3,294	9,593	13,153
Zinc:						
Oxides	11	46	538	751	360	14
Metal including alloys, all forms	9,901	8,138	5,019	4,817	73	190
Other:						
Ores and concentrates	32	57	67	182	281	113
Oxides, hydroxides, and peroxides of metals	6	NA	547	NA	439	791
Metals including alloys, all forms	4	9	288	66	1,160	2,213
NONMETALS						
Abrasives, natural, n.e.s.:						
Pumice, emery, natural corundum, etc	190	39	77	65	74	107
Corundum, artificial	47	140	49	242	115	23
Dust and powder of precious and semiprecious stone	NA	NA	NA	NA	3	--
Grinding and polishing wheels and stones	NA	NA	NA	NA	870	1,080
Asbestos	5,426	4,879	4,668	5,392	1,980	61
Barite and witherite	500	NA	24	NA	733	135
Boron materials, oxide and acid	12	31	50	127	36	40
Cement	31,380	33,479	3,149	3,697	2,466	7,412
Chalk	25	779	112	234	24	14
Clays and clay products (including all refractory brick):						
Crude: Andalusite, kyanite, etc	3,345	NA	2,479	NA	429	3,001
Products:						
Refractory (including nonclay bricks)	339	1,008	585	1,743	651	400
Nonrefractory	NA	NA	NA	NA	5,056	8,315

See footnotes at end of table.

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Table 4.—Israel: Imports of mineral commodities —Continued

Commodity	Quantity (metric tons unless otherwise specified)		Value, thousands			
			Of reported quantity		Of additional unreported quantity	
	1977[1]	1978	1977[1]	1978	1977[1]	1978
NONMETALS —Continued						
Diamond:						
Gem, not set or strung thousand carats	12,398	8,638	1,044,212	1,311,630	11,881	11,535
Industrial do	2,885	3,044	9,395	13,472	--	--
Diatomite and other infusorial earth	176	89	371	437	46	66
Feldspar and fluorspar	2,264	227	130	60	112	119
Fertilizer materials, manufactured:						
Nitrogenous	231	60	628	73	790	[illegible]
Other, including mixed	NA	4	NA	10	85	[illegible]
Graphite, natural	27	17	27	16	14	[illegible]
Gypsum and plasters	96	186	34	120	46	--
Magnesite	1,535	1,458	469	571	156	[illegible]
Mica	NA	24	NA	69	130	[illegible]
Pigments, mineral, including processed iron oxides	40	155	257	564	110	77
Precious and semiprecious stones, except diamond:						
Natural	NA	NA	NA	NA	12,338	19,714
Manufactured, including synthetic	NA	NA	NA	NA	195	192
Salt	66	NA	84	NA	232	796
Sodium and potassium compounds, n.e.s	616	177	414	159	301	331
Stone, sand and gravel:						
Dimension stone:						
Crude and partly worked	652	1,595	663	1,315	348	237
Worked	NA	NA	NA	NA	2,587	[illegible]
Dolomite, chiefly refractory grade	79	18	28	10	--	--
Gravel and crushed rock	3,649	NA	1,227	NA	55	1,796
Quartz and quartzite	420	104	100	53	6	--
Sand, excluding metal bearing	27	38	40	59	--	11
Sulfur:						
Elemental, all forms	NA	NA	NA	NA	3,041	[illegible]
Sulfur dioxide	NA	NA	NA	NA	80	--
Sulfuric acid	NA	8	NA	285	16	[illegible]
Talc, steatite, soapstone, pyrophyllite	80	120	142	167	116	[illegible]
Other:						
Crude	174	17	116	102	158	[illegible]
Oxides and hydroxides of magnesium, strontium, barium	13	9	32	82	49	[illegible]
Bromine, iodine, fluorine	NA	NA	NA	NA	42	41
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	NA	22	NA	49	197	[illegible]
MINERAL FUELS AND RELATED MATERIALS						
Carbon black	40	126	1,759	896	40	113
Coal, all grades, including briquets	195	305	94	167	50	140
Coke and semicoke	20	12	103	55	299	[illegible]
Gas, hydrocarbon, natural	1,862	2,334	436	580	--	1
Peat, including peat briquets and litter	28	154	106	50	141	[illegible]
Hydrogen and rare gases	10	2	90	102	933	[illegible]
Petroleum:*						
Crude and partly refined thousand 42-gallon barrels	55,720	NA	NA	NA	--	--
Refinery products:						
Lubricants do	120	NA	NA	NA	--	--
Other do	41	NA	NA	NA	--	--
Total do	161	NA	NA	NA	--	--
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	659	480	280	237	72	[illegible]

*Estimate. NA Not available.

[1] Many entries for 1977 have been revised from those shown in the previous edition of this chapter on the basis of revisions published in official Israeli trade returns for 1978.

COMMODITY REVIEW

METALS

Copper.—The Government-controlled company Israel Chemicals Ltd. was considering reopening the Timna copper mine, owing to the increased world copper price in 1979. The Timna operation was suspended in March 1976 because it was not viable at the then current price of copper.

Magnesium Compounds.—Dead Sea Periclase Ltd. (DSP) continued to make improvements in its facility near Arad. By the end of 1979, the capacity of the facility was 50,000 tons per year of sintered and calcined magnesium oxide. Production was 34,000 tons in 1978 and nearly 45,000 tons in 1979. The company also produced byproduct hydrochloric acid, which was used by Israel's domestic chemical industry. Most of DSP's magnesium oxide output was exported to western Europe for use in making refractories.

NONMETALS

Bromine.—Investments by Dead Sea Bromine Ltd. (DSB), which included modernization of production facilities and construction of a 100-ton-per-day chlorine gas plant, have resulted in an expansion of DSB's capacity to 60,000 tons per year of elemental bromine. Bromine Compounds Ltd., DSB's sister corporation, completed new facilities near Beersheba that brought its capacity to 60,000 tons per year of bromine compounds.

Fertilizer Materials.—*Phosphorous.*—Israeli production of phosphate rock increased in 1978 and 1979 as the Nahal Zin Mine (which opened in 1977) expanded to capacity. Israel's output of salable product increased from 1.72 million tons in 1978 to over 2.1 million tons in 1979. Domestic market absorbed approximately 300,000 tons in 1978 and 1979, and the remainder of production was available for export. Negev Phosphates Ltd., Israel's sole phosphate producer, planned to increase output to 2.5 million tons in 1980.

Rotem Fertilizer Ltd., a joint venture of Israeli and the Federal Republic of Germany, began building a new fertilizer complex on the Rotem Plain near Arad in 1978. The facility, to be constructed by Israeli engineers at a cost of $50 million, was planned to have a 500,000-ton-per-year sulfuric acid plant and a 120,000-ton-per-year phosphoric acid capacity. Plans were for phosphate rock from the nearby Mishor Rotem Mine to be used as feedstock for the phosphoric acid plant. The plant was scheduled to come online in 1981. The company planned to add facilities for the manufacture of triplesuperphosphate and complex fertilizer, and also for the extraction of uranium at a later date.

Haifa Chemicals Ltd. expanded its phosphoric acid capacity to 28,000 tons per year P_2O_5 and completed a 30,000-ton-per-year sodium-tripolyphosphate plant at its Haifa chemical complex in 1978. Fertilizers and Chemicals Ltd., also at Haifa, began construction of a 7,000-ton-per-year solid ammonium-polyphosphate facility that was scheduled for production in early 1980.

Potassium.—Dead Sea Works Ltd. (DSW) continued to produce near the 1.2-million-ton-per-year potash (KCL) capacity of its three plants at Sdom near the southern terminus of the Dead Sea. The company also had facilities for producing 500,000 tons per year of industrial salts and 50,000 tons per year of packaged table salt. Waste brines from the production of potash were used by DSB and DSP to produce elemental bromine and magnesium oxide. DSW announced that it had developed a new low-energy process for potash production that it claims will lower production costs by $6 per ton owing to the fuel savings. DSW planned to use the new process in two new plants that were scheduled to come online in 1982 and in 1985, with an expected increase in the company's production capacity to 2.1 million tons per year of KCL. DSW was also reconditioning a potash-granulation facility in 1979 and building new canals to extend and upgrade its evaporation pans.

MINERAL FUELS

Coal.—The Israeli Electric Corp. Ltd. was constructing a new coal-fired central power complex in 1978 and 1979 at Hadera. Plans were for the complex to have four 350-megawatt coal-fired units scheduled to come into service at yearly intervals beginning in 1980. It was estimated that 3.5 million tons per year of imported coal will be required when the plant is in full operation. Tentative agreements for the pur-

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chase of coal from the United States, Australia, and the Republic of South Africa were negotiated in 1978. The National Coal Board of the United Kingdom agreed to supply 250,000 tons per year of steam coal to Israel beginning in 1980.

Petroleum.—Israel began production of crude oil from the Alma field in the Gulf of Suez in April 1978 and was producing nearly 40,000 barrels per day when the field was released to Egypt in October 1979. Crude oil production from the Heletz field near Ashquelon continued to decline and averaged only 415 barrels per day in 1979. The Ashdod-5 well near the Mediterranean coast discovered a small field, and production began at 60 barrels per day in mid-1979. Israel continued to rely on imports to supply most of its 165,000-barrel-per-day requirements of crude oil and petroleum products. Oil Refineries Ltd. operated Israel's two oil refineries, a 66,000-barrel-per-day unit at Ashdod and a 135,000-barrel-per-day complex at Haifa.

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[1] Physical scientist, Branch of Foreign Data.

[2] Owing to fluctuations of the Israeli pound (I£), a meaningful conversion rate for 1979 is not possible. The average rate for 1978 was I£17.471=US$1.00. The exchange rate on Dec. 30, 1979, was I£35.44=US$1.00.

The Mineral Industry of Italy

By Roman V. Sondermayer[1]

Domestic and international economic problems affected the mineral industry of Italy during 1978 and 1979. The mining and metallurgical industry's economic growth continued to lag behind general economic trends, mostly owing to lack of significant improvement in the structure of the industry and to sluggish demand. High labor and other costs reduced profit margins, resulting in low investment in the mineral sector and significant financial losses in major Government-owned companies. Employment in mining was approximately 20,000 persons.

After the Ente Nazionale Gestione Aziende Minerarie e Metallurgiche (EGAM) was abolished in 1977, work on reorganization continued until the fall of 1978 when Ente Nazionale Idrocarburi (ENI), the state-controlled hydrocarbon agency, announced formation of an operating subsidiary to consolidate the mining, metallurgical, and industrial activities it had received from EGAM under the provisions of Law No. 26 of June 6, 1977.

The new company, Societá per Azioni Minero-Metallurgiche (SAMIM), was to comprise four directorates and five operational divisions as follows: Directorate for Planning, Directorate for Finance and Control, Directorate for Personnel and Organization, Directorate for Trade, Mining Division, Metallurgical Division, Division for Basic Minerals Research, Division for Development and New Initiatives, and the Division for Associated Companies.[2] Parliament has allocated 2,000 billion lire for this reorganization. The main aim was to save about 33,000 jobs which would be lost if EGAM's activities were halted.

During 1978 and 1979, major events in the mineral industry included the organization of SAMIM, planning for doubling capacity at the alumina plant at Porto Scuso in Sardinia, closing of two lead and zinc mines in Sardinia, expansion of the zinc smelter at Porto Vesme in Sardinia, beginning of development of a fluorspar mine and start of construction of the related mill near Rome, and agreement to construct a gas pipeline under the sea between Algeria and Italy.

PRODUCTION

The mineral industry obtained mixed results, as shown in table 1. The mining and processing sectors were owned by public and private enterprises, but the Government's ENI, with its affiliates SAMIM, AGIP, and SNAM, Italsider in steel, and Government-owned potash mines, controlled most of the sector. Societa Mineraria e Metallurgica di Pertusola, S.A. (Pertusola) in lead-zinc, Falck Acciaierie Ferriere Lombarde (Falck) in steel, and major foreign oil and gas companies were the chief prominent privately owned companies of the sector.

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Table 1.—Italy: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Bauxite	24,200	34,525	24,000	20,000
Alumina[e]	750,000	[r]792,308	808,558	810,000
Metal:				
Primary	206,465	260,110	267,607	[1]270,185
Secondary	198,000	225,000	222,000	230,000
Antimony:				
Mine output, metal content	[r]1,009	808	931	900
Regulus	1,471	768	398	400
Cadmium metal, smelter	436	449	383	400
Copper:				
Mine output, metal content	916	700	489	500
Metal, refined, secondary	[r]26,800	20,000	17,500	18,000
Iron and steel:				
Iron ore and concentrate[2] thousand tons	514	478	353	210
Metal:				
Pig iron do.	11,631	11,411	11,840	[1]11,227
Ferroalloys:				
Blast furnace do.	65	64	63	63
Electric furnace do.	192	191	187	194
Crude steel do.	[r]23,447	23,334	24,283	[1]24,250
Semimanufactures:				
Wire rod do.	1,309	1,483	1,775	NA
Sections do.	7,186	7,591	7,965	NA
Plates and sheets do.	5,559	5,591	5,545	NA
Hoop and strip do.	843	824	822	NA
Railway track material do.	235	199	197	NA
Ingots: Semimanufactures and solids for tubes do.	1,060	1,012	1,089	NA
Other do.	781	708	602	NA
Total do.	16,973	17,408	17,995	NA
Castings and forgings do.	570	669	631	NA
Cold-rolled sheet do.	2,893	2,829	2,785	NA
Seamless tubes do.	806	772	836	NA
Lead:				
Mine output, metal content	29,395	31,500	30,500	30,000
Metal:				
Primary	46,013	34,215	31,108	30,000
Secondary	72,187	83,500	85,100	85,000
Magnesium metal, primary	[r]8,800	8,800	9,700	8,000
Manganese, mine output:				
Gross weight	4,461	9,314	9,741	9,500
Metal content	1,338	2,798	2,143	2,000
Mercury metal 76-pound flasks	22,278	406	87	--
Silicon, elemental	17,700	[e]20,000	[e]18,000	18,000
Silver metal thousand troy ounces	1,593	1,222	890	1,000
Tin alloys	6,100	[e]6,100	[e]6,000	5,500
Zinc:				
Mine output, metal content	[r]86,400	79,300	73,329	[1]65,510
Metal, primary	[r]191,221	169,391	177,552	[1]202,782
NONMETALS				
Asbestos	164,788	149,327	135,402	120,000
Barite	179,107	136,369	236,613	214,600
Bromine[e]	558	590	590	500
Cement, hydraulic thousand tons	36,327	37,721	37,758	[1]40,160
Clays, crude:				
Bentonite do.	235	280	224	225
Refractory (excluding kaolinitic earth) do.	234	259	363	NA
For cement do.	5,781	NA	NA	NA
For brick and terra cotta do.	31,079	NA	NA	NA
Fuller's earth	[r]24,859	6,344	[e]7,000	12,000
Kaolin thousand tons	[r]82	81	71	73
Kaolinitic earth	27	20	3	NA
Diatomite	18,220	[e]30,000	NA	NA
Feldspar	182,605	213,593	251,083	250,000
Fluorspar, all grades	210,812	185,749	171,216	160,000
Graphite, all grades	3,848	3,819	4,108	4,000
Gypsum, except dimension stone use thousand tons	[r]3,925	4,180	[e]4,200	4,200
Lime, hydrated, and quicklime do.	2,188	2,197	2,141	2,100
Nitrogen, N content of ammonia do.	1,219	1,168	1,444	1,465
Perlite do.	95,000	90,000	90,000	90,000

See footnotes at end of table.

Table 1.—Italy: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Pigments, mineral: Iron oxides, natural[e]	2,000	1,700	1,400	1,000
Potash thousand tons	140	151	139	1,527
Pumice and related materials:[e]				
Pumice and pumiceous lapilli do	[r]862	[r]750	780	850
Pozzolan do	[r]5,080	5,700	5,800	5,900
Pyrite, all types, gross weight do	850	863	786	750
Salt:				
Marine, crude do	603	1,430	1,210	1,200
Rock and brine do	3,410	3,600	3,721	3,900
Sand and gravel:				
Silica sand do	4,261	NA	NA	NA
Volcanic sand do	181	NA	NA	NA
Other sand and gravel do	124,736	NA	NA	NA
Sodium and potassium compounds:				
Caustic soda	11,391	11,150	9,871	10,000
Sodium carbonate thousand tons	94	95	95	95
Sodium sulfate do	672	710	725	730
Stone:				
Dimension stone:				
Calcareous:				
Alabaster and onyx do	5,425	NA	NA	NA
Limestone do	50,147	[e]47,200	[e]47,200	NA
Marble in blocks:				
White do	1,170	[e]1,100	[e]1,100	NA
Colored do	821	[e]800	[e]800	NA
Schist do	154	[e]135	[e]135	NA
Travertine do	NA	1,330	1,330	[1]1,302
Tufa do	NA	[e]7,200	[e]7,200	[1]7,242
Other:				
Gneiss do	461	440	440	NA
Granite do	793	740	740	NA
Lava, basalt, trachyte do	5,733	5,660	5,660	NA
Porphyry do	489	530	530	NA
Sandstone do	1,417	1,350	1,350	NA
Serpentine do	2,506	2,500	2,500	NA
Slate do	98	100	100	NA
Tuff, volcanic do	5,287	5,100	5,100	NA
Crushed and broken:				
Dolomite do	NA	1,000	1,000	NA
Limestone do	NA	[e]47,200	[e]47,200	NA
Quartz and quartzite do	NA	480	480	NA
Strontium minerals[e]	700	700	700	700
Sulfur:				
Gross weight of ore thousand tons	350	638	357	360
Recovered as elemental and in compounds:				
Elemental from ore do	35	36	16	16
S content of pyrite do	366	371	330	330
Byproduct, all sources[e] do	211	259	250	250
Total do	612	666	596	596
Talc and related materials	153,836	162,437	175,157	175,157
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bituminous rock, natural:				
For distillation	54,299	64,924	NA	NA
For paving	76,177	77,419	NA	NA
Carbon black	144,045	158,630	155,763	170,000
Coal:				
Subbituminous (sulcis coal) thousand tons	1	(3)	--	--
Lignite do	2,028	1,871	1,868	[1]2,123
Coke, metallurgical do	7,970	7,676	7,317	7,300
Gas, natural, marketed million cubic feet	552,336	485,115	484,932	[1]475,553
Natural gas liquids: Natural gasoline thousand 42-gallon barrels	120	281	NA	NA
Petroleum:				
Crude do	7553	6,139	9,892	[1]11,458
Refinery products:				
Gasoline:				
Aviation do	376	416	303	[1]146,191
Motor do	122,363	135,462	138,975	
Jet fuel do	12,920	12,988	15,680	[1]14,640
Kerosine do	26,760	28,104	28,436	[1]27,660
Distillate fuel oil do	200,527	198,706	222,584	[1]228,671

See footnotes at end of table.

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Table 1.—Italy: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978ᵖ	1979ᵉ
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Residual fuel oil thousand 42-gallon barrels	289,148	305,342	318,448	[1]321,221
Lubricants do	4,795	5,586	5,965	6,000
Other do	128,953	125,396	85,632	86,000
Refinery fuel and losses do	47,145	49,180	54,263	55,000
Total do	832,987	856,180	865,306	885,000

ᵉEstimate. ᵖPreliminary. ʳRevised. NA Not available.

[1] Reported figure.

[2] Excludes pelletized iron oxide derived from pyrite.

[3] Less than 1/2 unit.

TRADE

Italy was dependent on imports of large quantities of raw material for production of metals and fuels. Details on foreign trade are shown in tables 2 and 3. The United States had a negative mineral trade balance with Italy.

Table 2.—Italy: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite	6,744	12,240	Greece 5,110; Federal Republic of Germany 2,515; France 2,427.
Oxide and hydroxide	332,277	327,599	Netherlands 110,101; Norway 104,232; U.S.S.R. 43,292.
Ash and residue containing aluminum	3,939	6,609	Federal Republic of Germany 3,273; France 2,927.
Metal including alloys:			
Scrap	522	1,023	Federal Republic of Germany 770.
Unwrought	24,367	69,933	Federal Republic of Germany 24,212; China, mainland, 9,500.
Semimanufactures	90,366	108,802	Federal Republic of Germany 22,872; France 19,425; United States 10,604.
Antimony:			
Ore and concentrate	--	36	All to United States.
Metal including alloys, all forms	1,145	61	Federal Republic of Germany 30; Netherlands 20.
Arsenic:			
Trioxide, pentoxide, acids	238	NA	
Arsenic and tellurium, elemental	69	([3])	NA.
Bismuth metal including alloys, all forms	31	30	NA.
Cadmium metal including alloys, all forms	140	124	Belgium-Luxembourg 42; Netherlands 40; Federal Republic of Germany 38.
Chromium:			
Chromite	2,137	3,606	Romania 1,810.
Oxide and hydroxide	1,037	1,835	France 1,222; Switzerland 95; Taiwan 53; United Kingdom 40.
Metal including alloys, all forms	10	39	NA.
Cobalt:			
Oxide and hydroxide	([3])	10	NA.
Metal including alloys, all forms	29	97	Federal Republic of Germany 41; United Kingdom 15; Netherlands
Columbium and tantalum metals, all forms, including waste and scrap	3	17	NA.
Copper:			
Ore and concentrate	1,604	2,595	Spain 1,440; Bulgaria 650.
Ash and residue containing copper	9,895	13,525	Federal Republic of Germany 8,552; Austria 3,787; German Democratic Republic 550.
Copper sulfate	3,106	2,597	France 954; Greece 660; Federal Republic of Germany 389.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Copper —Continued			
Cement copper	378	45	Netherlands 22.
Metal including alloys:			
Scrap	11,029	9,088	Federal Republic of Germany 7,373; France 341.
Unwrought:			
Blister	2,181	877	Federal Republic of Germany 344; France 331; Austria 137.
Refined, unalloyed	790	751	Federal Republic of Germany 561; Switzerland 153.
Alloys	1,817	1,574	Federal Republic of Germany 481; France 271; Austria 226.
Semimanufactures	59,720	94,100	France 20,683; Federal Republic of Germany 18,033; Yugoslavia 9,771.
Gallium, indium, thallium kilograms	--	100	NA.
Germanium metal including alloys, all forms	17	8	NA.
Iron and steel:			
Ore and concentrate, except roasted pyrite	3,225	10,703	NA.
Roasted pyrite thousand tons	128	67	France 52.
Metal:			
Scrap do.	11	7	Federal Republic of Germany 3; France 2.
Pig iron, cast iron, spiegeleisen, powder, shot do.	9	17	Federal Republic of Germany 5; France 1; United Kingdom 1.
Ferroalloys do.	23	32	Federal Republic of Germany 7; France 6; Belgium-Luxembourg 4.
Steel, primary forms do.	923	995	United States 220; France 127; Greece 122.
Semimanufactures:			
Bars, rods, angles, shapes, sections do.	2,542	3,753	Federal Republic of Germany 1,030; France 555; Libya 118.
Universals, plates, sheets do.	1,306	1,433	United States 306; France 224; Federal Republic of Germany 155.
Hoop and strip do.	75	126	Greece 23; France 21; U.S.S.R. 13; Bulgaria 7.
Rails and accessories do.	41	23	Poland 8; Switzerland 4; Netherlands 3; United States 2.
Wire do.	64	81	France 19; Federal Republic of Germany 12; Algeria 8.
Tubes, pipes, fittings do.	1,752	1,881	U.S.S.R. 499; Mexico 229; Federal Republic of Germany 196.
Castings and forgings, rough do.	8	5	France 2; Libya 2; Federal Republic of Germany 1.
Total do.	5,788	7,252	
Lead:			
Ore and concentrate	26,980	19,207	Greece 11,400; Austria 4,282; U.S.S.R. 3,500.
Ash and residue containing lead	19,077	7,920	France 7,757.
Oxide	585	1,936	Austria 770; Hungary 292; Czechoslovakia 240.
Metal including alloys:			
Scrap	23	95	NA.
Unwrought	4,123	8,312	Federal Republic of Germany 3,296; Romania 2,000; Egypt 921.
Semimanufactures	644	653	Saudi Arabia 345; Libya 145.
Magnesium metal including alloys:			
Scrap	1,006	638	United States 323; France 128.
Unwrought	4,208	4,795	Federal Republic of Germany 4,310; Belgium-Luxembourg 325.
Semimanufactures	12	290	France 164; Nigeria 27; Norway 13.
Manganese:			
Ore and concentrate	37	30	NA.
Oxide and hydroxide	19	4	NA.
Metal, all forms	20	18	NA.
Mercury 76-pound flasks	10,301	22,394	United States 5,129; France 4,096; India 3,562.
Molybdenum:			
Ore and concentrate	459	269	Austria 155; Netherlands 79; Federal Republic of Germany 24.
Metal including alloys, all forms	32	20	NA.

See footnotes at end of table.

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Table 2.—Italy: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Nickel:			
Matte, speiss, similar materials	16	--	
Metal including alloys:			
Scrap	212	161	France 56.
Unwrought	282	100	Netherlands 45; Yugoslavia 30.
Semimanufactures	1,708	511	Morocco 94; France 54; Yugoslavia 51.
Platinum-group and silver metals including alloys:			
Platinum-group ___ thousand troy ounces	122	81	Federal Republic of Germany 25; United Kingdom 17; United States 17.
Silver ___ do	1,562	1,379	United Kingdom 354; Switzerland 103; France 19.
Rare-earth metals:			
Oxides and other compounds ___ value	$4,394	$379	NA.
Metals including alloys	218	141	NA.
Selenium, elemental ___ kilograms	47,698	200	NA.
Silicon, elemental	4,235	5,780	Federal Republic of Germany [illegible]; Japan 796; U.S.S.R. 540.
Thorium:			
Ore and concentrate ___ kilograms	1,830	9,900	NA.
Thoria ___ value	--	$656,170	France $634 374.
Tin:			
Oxide	190	NA	
Metal including alloys, all forms	683	331	Denmark 100; France 70; Algeria 11.
Titanium:			
Ore and concentrate	5	3	NA.
Oxides	29,017	25,604	Federal Republic of Germany 3,166; France 3,318; United Kingdom 2,326.
Metal including alloys, all forms	119	137	Federal Republic of Germany 76; Belgium-Luxembourg 24.
Tungsten:			
Ore and concentrate	13	--	
Metal including alloys, all forms	117	33	Federal Republic of Germany 25.
Uranium metal including alloys, all forms ___ kilograms	284	--	
Vanadium:			
Oxide and hydroxide	--	56	Netherlands 38.
Metal including alloys, all forms	88	28	NA.
Zinc:			
Ore and concentrate	2,286	32	NA.
Matte, ash, and residue containing zinc	21,345	18,783	France 13,435; Federal Republic of Germany 1,568; Sweden 1,451.
Oxide	1,451	3,154	Federal Republic of Germany 1,071; France 924; Hungary 572.
Metal including alloys:			
Scrap	2,732	1,445	Federal Republic of Germany 706; France 540.
Blue powder	252	602	Romania 501.
Unwrought	27,736	29,396	United States 15,725; Netherlands 8,599; France 1,436.
Semimanufactures	549	756	Federal Republic of Germany 115; Spain 89; Saudi Arabia 62.
Zirconium:			
Ore and concentrate	1,288	2,750	Hungary 1,739; France 960.
Metal including alloys, all forms	3	--	
Other:			
Ores and concentrates	96	171	Federal Republic of Germany 32; Belgium-Luxembourg 7.
Ash and residue containing nonferrous metals	3,765	6,346	Federal Republic of Germany 3,172; United Kingdom 705; France 128.
Oxides and hydroxides	560	2,860	Federal Republic of Germany 453; Netherlands 261; France 252.
Metals including alloys, all forms:			
Metalloids, n.e.s	3,695	--	
Alkali and alkaline-earth metals, n.e.s	702	312	NA.
Pyrophoric alloys	2	NA	
Base metals including alloys, all forms, n.e.s	10	10	NA.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	227,313	294,561	United Kingdom 220,219; United States 18,108; Algeria 13,770.
Dust and powder of precious and semiprecious stones ___ kilograms	33	18	Switzerland 9.
Grinding and polishing wheels and stones	14,716	15,627	France 1,848; Romania [illegible]; Federal Republic of Germany 1,243.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Asbestos	67,106	68,923	Federal Republic of Germany 20,228; Poland 7,591; France 6,718.
Barite and witherite	20,264	73,863	Algeria 62,778; Libya 3,144; Egypt 1,899; Malta 600.
Boron materials:			
Crude natural borates	310	155	United States 54.
Oxide and acid	7,897	4,444	Federal Republic of Germany 1,695; France 1,178; United States 426.
Cement	702,944	1,585,389	Nigeria 400,065; Libya 180,098; Israel 133,782; Iran 112,009.
Chalk	633	574	NA.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	18,605	20,205	Libya 7,887; Philippines 840; Nigeria 413.
Kaolin	64,596	42,546	France 28,483; Greece 12,273.
Other	4,961	7,725	Tunisia 1,150; Iran 359; Venezuela 266.
Products:			
Refractory (including nonclay brick)	90,977	105,508	Federal Republic of Germany 14,391; Saudi Arabia 12,101; France 9,092.
Nonrefractory thousand tons	2,086	2,365	Federal Republic of Germany 598; France 488; United States 106.
Cryolite and chiolite	(1)	2	NA.
Diamond:			
Gem, not set or strung carats	437	237	NA.
Industrial do.	2,169	2,960	Brazil 2,732.
Diatomite and other infusorial earth	1,038	1,185	Switzerland 389.
Feldspar	29,415	28,808	Federal Republic of Germany 13,848; Greece 3,186; Netherlands 2,631.
Fertilizer materials:			
Crude	7,519	7,836	France 4,613.
Manufactured:			
Nitrogenous thousand tons	894	1,199	Turkey 284; China, mainland, 191; Egypt 130; India 107.
Phosphatic do.	9	7	Nigeria 6; France 1.
Potassic do.	132	107	Algeria 29; Greece 25; Republic of Korea 13; North Korea 10.
Other do.	305	385	Venezuela 84; China, mainland, 69; France 51.
Ammonia	38,500	47,208	Greece 21,823; Israel 13,635; Turkey 7,870.
Fluorspar	55,749	60,952	United States 42,000; Federal Republic of Germany 8,150; Romania 1,092.
Graphite, natural	1,971	2,823	France 1,624.
Gypsum and plasters	11,498	11,153	NA.
Lime	66,819	124,561	Saudi Arabia 71,576; Switzerland 24,775; Libya 21,151.
Lithium ore	11	--	
Magnesite	20,088	131,459	Federal Republic of Germany 28,313; United Kingdom 18,181; Austria 15,375.
Mica:			
Crude, including splittings and waste	1,070	800	Federal Republic of Germany 163.
Worked, including agglomerated splittings	115	54	NA.
Pigments, mineral, including processed iron oxides	1,383	1,034	German Democratic Republic 229; Federal Republic of Germany 202.
Precious and semiprecious stones, except diamond:			
Natural kilograms	1,912	1,743	NA.
Manufactured do.	931	442	NA.
Pyrite, gross weight	23,832	3,189	Federal Republic of Germany 1,522; Austria 442.
Salt, all forms	192,618	497,316	United Kingdom 180,209; Denmark 82,934; Federal Republic of Germany 59,916.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	560,484	326,877	Yugoslavia 100,487; U.S.S.R. 32,218; China, mainland, 19,418.
Caustic potash	2,931	8	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	328,433	337,475	Spain 50,962; France 24,417; Federal Republic of Germany 21,820.
Slate	2,437	3,168	Belgium-Luxembourg 1,180.
Other	123,401	106,667	Federal Republic of Germany 39,626; Switzerland 14,112; Austria 3,943.

See footnotes at end of table.

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Table 2.—Italy: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Stone, sand and gravel —Continued			
Dimension stone —Continued			
Worked:			
Slate	33,794	35,154	United States 20,015; Austria 2,949; Canada 1,998.
Paving stone and flagstone	53,961	95,775	Federal Republic of Germany 43,132; Switzerland 29,485; Austria 8,974.
Other	890,154	955,829	Federal Republic of Germany 379,633; Saudi Arabia 127,682; France 112,590.
Dolomite, chiefly refractory grade	29,956	29,670	Switzerland 4,372; Federal Republic of Germany 4,017; Austria 3,543.
Gravel and crushed rock	547,891	643,828	Switzerland 126,402; Federal Republic of Germany 103,814; Kuwait 54,716.
Limestone, except dimension	364	72	NA.
Quartz and quartzite:			
Piezoelectric crystal kilograms	--	30	NA.
Other	45,242	37,798	Switzerland 16,787; France 12,746; Federal Republic of Germany 3,191.
Sand, excluding metal bearing	441,432	434,043	Switzerland 392,754; Libya 2,346.
Sulfur:			
Elemental, all forms	4,262	3,797	Yugoslavia 1,532; Federal Republic of Germany 1,107; France 620.
Sulfur dioxide	1,156	NA	
Sulfuric acid	93,063	81,097	Spain 26,558; Turkey 12,976; Greece 2,978.
Talc, steatite, soapstone	59,065	56,591	Federal Republic of Germany 18,861; France 9,687; United Kingdom 9,495.
Other:			
Crude:			
Meerschaum, amber, jet	37	NA	
Other	81,256	87,542	United Kingdom 60,830; Switzerland 8,124; Netherlands 2,500.
Slag, dross, and similar waste, not metal bearing	240,970	307,019	Yugoslavia 264,963; Austria 27,760.
Oxides, hydroxides, and peroxides of magnesium, strontium, barium	1,962	2,396	United States 683; United Kingdom 427; Denmark 105.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	121,791	141,317	France 47,713; Libya 22,621; Federal Republic of Germany 18,559.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,626	6,018	Algeria 2,816; Tanzania 1,987.
Carbon black and gas carbon	38,037	39,493	Yugoslavia 11,306; France 7,789; Austria 7,322.
Coal, all grades, including briquets	15,282	5,554	France 3,675; Argentina 848.
Coke and semicoke	593,304	625,167	United States 192,320; Algeria 122,562; Romania 114,754.
Gas, natural thousand cubic feet	174	502	NA.
Peat	544	730	NA.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	55,333	66,590	Netherlands 17,002; United Kingdom 12,023; France 4,900.
Kerosine do	18,941	22,310	Greece 2,724; Egypt 1,447; Libya 1,437; United Kingdom 1,254.
Distillate fuel oil do	38,077	49,721	France 7,477; Netherlands 7,195; Federal Republic of Germany 4,813.
Residual fuel oil do	45,888	57,550	United States 9,711; Turkey 4,647; United Kingdom 3,135.
Lubricants do	2,788	3,298	Belgium-Luxembourg 414; Vietnam 289; Federal Republic of Germany 286.
Other:			
Liquefied petroleum gas do	5,364	5,461	Algeria 878; Egypt 764; Morocco 700; Portugal 456.
Mineral jelly and wax do	14	18	Switzerland 13.
Bitumen and other residues do	1,125	1,228	Austria 527; Switzerland 281; Tunisia 147; Algeria 131.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum refinery products —Continued			
Other —Continued			
Bituminous mixtures, n.e.s thousand 42-gallon barrels	56	46	Sudan 11; Libya 6; Kuwait 5; Poland 2.
Petroleum coke and pitch do.	269	275	Switzerland 145; France 47; Greece 46.
Total do.	167,855	206,497	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	52,959	61,634	France 24,699; Yugoslavia 18,074; China, mainland, 1,709.

NA Not available.
[1]Less than 1/2 unit.

Table 3.—Italy: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite thousand tons	1,939	1,645	Australia 1,080; Guinea 468; Guyana 39.
Ash and residue containing aluminum	56,780	61,782	Austria 39,650; Yugoslavia 9,889; France 6,375.
Oxide and hydroxide	145,984	166,841	Guinea 107,725; France 24,270; Federal Republic of Germany 14,910.
Metal including alloys:			
Scrap	45,342	41,448	Federal Republic of Germany 11,747; France 9,076; Switzerland 8,081.
Unwrought	242,917	231,849	Federal Republic of Germany 62,855; France 38,568; Greece 26,324.
Semimanufactures	60,750	62,312	Federal Republic of Germany 25,957; France 13,166; Belgium-Luxembourg 7,007.
Antimony:			
Ore and concentrate	720	--	
Metal including alloys, all forms	121	152	Belgium-Luxembourg 81; France 26.
Arsenic:			
Trioxide, pentoxide, acids	917	NA	
Arsenic and tellurium, elemental	47	78	United States 18; United Kingdom 2.
Beryllium metal including alloys, all forms kilograms	1,837	1,700	NA.
Bismuth metal including alloys, all forms	96	61	United Kingdom 24.
Cadmium metal including alloys, all forms	148	179	Finland 100; Federal Republic of Germany 57.
Chromium:			
Chromite	187,389	140,186	Turkey 58,117; Republic of South Africa 31,755; Albania 20,943.
Oxide and hydroxide	1,684	1,357	Federal Republic of Germany 972; France 125; U.S.S.R. 100.
Metal including alloys, all forms	88	206	France 68; United Kingdom 61.
Cobalt:			
Oxide and hydroxide	254	214	Belgium-Luxembourg 172; France 41.
Metal including alloys, all forms	312	369	Belgium-Luxembourg 155; France 105; United Kingdom 28.
Columbium and tantalum metals, all forms, including waste and scrap	15	9	United States 5; Austria 1.
Copper:			
Ore and concentrate	30	16	NA.
Cement copper	704	54	All from Austria.
Copper sulfate	975	3,213	Austria 1,380; France 884; Czechoslovakia 460.
Ash and residue containing copper	334	227	NA.
Metal including alloys:			
Scrap	72,639	69,579	United Kingdom 21,220; Federal Republic of Germany 19,981; France 19,459.
Unwrought:			
Blister	5,778	4,654	Chile 3,641; Yugoslavia 449.
Refined, unalloyed	299,584	351,646	Chile 92,222; Zambia 50,576; Belgium-Luxembourg 31,332.
Alloys	16,786	14,447	Yugoslavia 3,828; Poland 2,879; United Kingdom 2,848.

See footnotes at end of table.

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Table 3.—Italy: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Copper —Continued			
Metal including alloys —Continued			
Semimanufactures	56,038	69,492	Federal Republic of Germany 24,261; France 14,505; Belgium-Luxembourg 6,172.
Gallium, indium, thallium kilograms	708	1,000	United Kingdom 900.
Germanium do	1,676	100	NA.
Iron and steel:			
Ore and concentrate thousand tons	14,694	16,297	Brazil 3,790; Liberia 3,318; Venezuela 1,606.
Roasted pyrite	468	173	NA.
Metal:			
Scrap thousand tons	5,868	6,566	France 2,972; Federal Republic of Germany 2,045; U.S.S.R. 159.
Pig iron, cast iron, spiegeleisen do	680	347	Federal Republic of Germany 97; Sweden 72; Brazil 56.
Sponge iron, powder, shot do	38	68	Canada 36; Venezuela 14; France 7; Sweden 7.
Ferroalloys:			
Ferromanganese do	128	106	France 52; Republic of South Africa 16; Federal Republic of Germany 14.
Other do	155	187	Republic of South Africa 34; France 28; Sweden 27.
Total do	283	293	
Steel, primary forms do	2,553	2,210	France 681; Belgium-Luxembourg 290; Federal Republic of Germany 248.
Semimanufactures:			
Bars, rods, angles, shapes, sections thousand tons	724	584	Federal Republic of Germany 253; France 204; Algeria 107.
Universals, plates, sheets do	1,675	1,255	France 445; Belgium-Luxembourg 204; Federal Republic of Germany 130.
Hoop and strip do	150	165	France 62; Federal Republic of Germany 52; Belgium-Luxembourg 18.
Rails and accessories do	63	139	Canada 44; Federal Republic of Germany 35; France 34.
Wire do	53	54	Belgium-Luxembourg 24; France 13; Federal Republic of Germany 9.
Tubes, pipes, fittings do	158	169	France 61; Federal Republic of Germany 52; Austria 5.
Castings and forgings, rough do	4	5	Federal Republic of Germany 2; France 1; Switzerland 1.
Total do	2,827	2,371	
Lead:			
Ore and concentrate	14,264	18,589	Morocco 5,829; Greece 5,664; Denmark 3,034.
Ash and residue containing lead	881	8,555	Hungary 4,782; Federal Republic of Germany 2,828.
Oxide	6,585	3,671	Netherlands 2,945; Federal Republic of Germany 305.
Metal including alloys:			
Scrap	41,124	38,275	France 19,382; Switzerland 6,437; Federal Republic of Germany 5,503.
Unwrought	163,625	138,318	Federal Republic of Germany 36,524; Republic of South Africa 19,386; Mexico 14,719.
Semimanufactures	1,216	974	NA.
Magnesium metal including alloys:			
Scrap	2,515	2,251	Federal Republic of Germany 1,275; Austria 297; Netherlands 209.
Unwrought	578	1,082	Norway 503; United States 219; France 132.
Semimanufactures	231	327	United States 192; Switzerland 42; United Kingdom 18.
Manganese:			
Ore and concentrate	269,243	284,319	Republic of South Africa 150,953; Gabon 75,484; Brazil 35,961.
Oxides	1,908	2,850	Greece 1,058; Belgium-Luxembourg 1,016.
Metal, all forms	1,145	1,165	Republic of South Africa 734; France 219.

See footnotes at end of table.

Table 3.—Italy: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Mercury 76-pound flasks	570	1,297	NA.
Molybdenum:			
Ore and concentrate	5,808	5,637	Netherlands 3,968; United States 636; Belgium-Luxembourg 382.
Metal including alloys, all forms	188	176	Austria 67; United States 53; Netherlands 15.
Nickel:			
Matte, speiss, similar materials	5,702	7,557	Canada 3,554; Cuba 2,757; Australia 569.
Metal including alloys:			
Scrap	970	299	Canada 125.
Unwrought	11,509	11,912	Republic of South Africa 2,703; United States 2,269; Netherlands 1,973.
Semimanufactures	2,256	2,318	United Kingdom 712; Federal Republic of Germany 667; France 261.
Platinum-group and silver metals including alloys:			
Platinum-group thousand troy ounces	435	455	Federal Republic of Germany 256; Republic of South Africa 95; United Kingdom 59.
Silver do	30,916	31,768	United States 9,986; Federal Republic of Germany 7,842; United Kingdom 7,321.
Rare-earth metals:			
Oxides and other compounds value, thousands	$569	$795	France $666; Austria $103.
Metals:			
Cerium	12	NA	
Other	430	122	Federal Republic of Germany 92.
Selenium, elemental	27	21	United Kingdom 9.
Silicon, elemental	4,779	5,579	Yugoslavia 2,136; France 1,697; Sweden 598.
Thorium:			
Ore and concentrate	NA	20	NA.
Thoria value	$122,969	$7,486	NA.
Tin:			
Ore and concentrate	2	--	
Oxide	18	NA	
Metal including alloys:			
Scrap	3	--	
Unwrought	6,758	6,426	Malaysia 2,530; Indonesia 2,414; Thailand 470.
Semimanufactures	298	214	Federal Republic of Germany 68; Belgium-Luxembourg 31; France 23.
Titanium:			
Ore and concentrate	141,512	126,428	Australia 84,408; Norway 41,809.
Oxides	36,693	44,716	Federal Republic of Germany 17,065; France 11,073; Belgium-Luxembourg 4,669.
Metal including alloys, all forms	1,954	2,769	Austria 888; United States 760; Federal Republic of Germany 434.
Tungsten:			
Ore and concentrate	25	126	All from Canada.
Metal including alloys, all forms	100	124	Federal Republic of Germany 25; France 23; United Kingdom 16.
Uranium metal including alloys, all forms kilograms	200	300	NA.
Vanadium:			
Ore and concentrate	924	[1]1,798	NA.
Oxide and hydroxide	375	1,009	Austria 732; Federal Republic of Germany 156; Republic of South Africa 98.
Metal including alloys, all forms	(2)	2	NA.
Zinc:			
Ore and concentrate	193,432	206,600	Ireland 51,311; Peru 39,869; France 28,030.
Matte, ash, and residue containing zinc	8,466	6,665	Federal Republic of Germany 2,650; Switzerland 2,568.
Oxide and hydroxide	2,602	2,248	France 764; Federal Republic of Germany 662; Netherlands 492.
Metal including alloys:			
Scrap	1,596	1,710	Federal Republic of Germany 538; France 405.
Blue powder	2,035	444	Norway 133; France 108; Federal Republic of Germany 47.

See footnotes at end of table.

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Table 3.—Italy: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Zinc —Continued			
Metal including alloys —Continued			
Unwrought	66,381	54,043	Federal Republic of Germany 13,806; Belgium-Luxembourg 10,149; Netherlands 7,572.
Semimanufactures	1,970	2,038	Belgium-Luxembourg 866; France 497; Federal Republic of Germany 290.
Zirconium:			
Ore and concentrate	42,558	42,209	Australia 41,329; France 556; Republic of South Africa 149.
Metal including alloys, all forms kilograms	30,786	24,200	Sweden 9,400; Federal Republic of Germany 4,900; France 3,000.
Other:			
Ores and concentrates	7,704	508	NA.
Ash and residue containing nonferrous metals	6,941	15,417	Republic of South Africa 3,587; Canada 2,678; Federal Republic of Germany 1,708.
Oxides, hydroxides, peroxides of metals	6,670	7,725	Cuba 3,030; Federal Republic of Germany 1,585; Belgium-Luxembourg 343.
Metals including alloys, all forms:			
Metalloids	57	1	NA.
Alkali, alkaline-earth, rare-earth metals, n.e.s	7,055	6,573	Federal Republic of Germany 4,386; France 1,395.
Pyrophoric alloys	13	NA	
Base metals including alloys, all forms, n.e.s	60	5	NA.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	3,682	3,551	Federal Republic of Germany 1,065; Yugoslavia 460.
Dust and powder of precious and semiprecious stones kilograms	1,122	1,111	United States 472; Ireland 448.
Grinding and polishing wheels and stones	4,155	3,689	Austria 969; Federal Republic of Germany 521; United Kingdom 472.
Asbestos	65,468	47,189	Republic of South Africa 22,960; Canada 12,212; U.S.S.R. 7,423.
Barite and witherite	18,538	13,871	France 6,081; Spain 5,648; Federal Republic of Germany 600.
Boron materials:			
Crude and natural borates	165,578	186,808	Turkey 153,802; United States 29,299; Federal Republic of Germany 1,991.
Oxide and acid	2,039	843	United States 848.
Cement	68,426	67,729	France 52,921; Yugoslavia 8,136; Spain 4,082.
Chalk	14,983	15,235	France 14,598.
Clays and clay products:			
Crude:			
Bentonite	65,595	54,673	Greece 45,949; Belgium-Luxembourg 2,720; Spain 1,568.
Kaolin	649,279	673,576	United Kingdom 305,469; United States 152,208; Federal Republic of Germany 125,501.
Other	678,444	579,406	France 235,613; Federal Republic of Germany 190,844; United Kingdom 78,308.
Products:			
Refractory (including nonclay brick)	141,439	80,571	Federal Republic of Germany 25,796; United Kingdom 17,493; France 11,498.
Nonrefractory	18,806	20,940	Federal Republic of Germany 9,577; France 5,356; Switzerland 3,942.
Cryolite and chiolite	2,812	1,228	Denmark 1,176.
Diamond:			
Gem, not set or strung carats	109,014	99,360	Belgium-Luxembourg 60,361; Israel 14,806.
Industrial do	140,923	190,374	Belgium-Luxembourg 123,249; Netherlands 28,043; Republic of South Africa 12,199.
Diatomite and other infusorial earth	3,748	5,391	Federal Republic of Germany 2,412; France 1,498; United States 514.
Feldspar	29,737	29,143	Canada 13,387; Norway 7,087; Federal Republic of Germany 2,069.

See footnotes at end of table.

Table 3.—Italy: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Fertilizer materials:			
Crude:			
Nitrogenous	546	3,539	Belgium-Luxembourg 3,427.
Phosphatic thousand tons	1,602	1,619	Morocco 744; United States 304; Israel 228.
Potassic	22,948	19,153	France 17,431; Federal Republic of Germany 1,683.
Other	2,307	3,911	France 2,113.
Manufactured:			
Nitrogenous	98,347	127,327	Austria 38,277; Federal Republic of Germany 34,695; France 27,104.
Phosphatic	95,658	110,643	France 32,444; Tunisia 27,375; United States 15,522.
Potassic	456,247	531,169	U.S.S.R. 146,906; Israel 144,133; German Democratic Republic 90,417.
Other	504,042	810,127	United States 642,051; Yugoslavia 46,987; Federal Republic of Germany 32,811.
Ammonia	192,966	229,592	U.S.S.R. 66,029; United States 51,717; Mexico 37,180.
Fluorspar	33,905	46,973	Spain 31,441; Morocco 6,675; Mexico 5,875.
Graphite, natural	4,802	5,535	Federal Republic of Germany 2,317; Austria 860; U.S.S.R. 501.
Gypsum and plasters	16,362	17,960	Austria 15,127; United States 1,220; Federal Republic of Germany 819.
Lime	682	466	NA.
Lithium	1,389	NA	
Magnesite	57,965	66,904	Greece 39,658; Austria 8,508; Yugoslavia 3,857.
Mica:			
Crude, including splittings and waste	1,587	1,246	United States 115.
Worked, including agglomerated splittings	301	330	France 111; Belgium-Luxembourg 87; Spain 60.
Pigments, mineral: Iron oxides	20,864	17,730	Federal Republic of Germany 12,230; United Kingdom 450; United States 366.
Precious and semiprecious stones, except diamond:			
Natural kilograms	63,208	72,496	Brazil 33,677; Federal Republic of Germany 7,463.
Manufactured do	13,312	11,312	Switzerland 7,208; France 2,902.
Pyrite, gross weight thousand tons	164	247	U.S.S.R. 216; Cyprus 27.
Salt	205,771	195,252	Spain 116,369; Tunisia 47,897; U.S.S.R. 11,943.
Sodium and potassium compounds, n.e.s	132,071	70,612	France 46,693; Federal Republic of Germany 15,242; Belgium-Luxembourg 5,228.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous, including marble	146,984	133,696	Yugoslavia 30,779; Portugal 24,466; Spain 21,573.
Slate	1,714	2,521	NA.
Other	249,454	293,949	Republic of South Africa 66,638; Spain 49,502; Finland 42,194.
Worked, all forms	7,346	4,119	France 1,353; Federal Republic of Germany 242.
Dolomite, chiefly refractory grade	983	872	NA.
Gravel and crushed rock	8,424	8,736	France 4,674.
Limestone, except dimension	82	1,003	NA.
Quartz and quartzite:			
Piezoelectric crystal kilograms	49	149	NA.
Other	49,307	42,995	Switzerland 30,221; Federal Republic of Germany 7,289; Greece 2,499.
Sand, excluding metal bearing thousand tons	1,103	1,067	France 686; Belgium-Luxembourg 268; Federal Republic of Germany 84.
Sulfur:			
Elemental:			
Other than colloidal	628,496	606,051	Canada 297,341; Poland 156,724; France 113,168.
Colloidal	1,954	1,573	Federal Republic of Germany 1,376.
Sulfur dioxide	637	NA	
Sulfuric acid	16,224	44,567	Federal Republic of Germany 12,607; United Kingdom 7,329; Netherlands 6,235.
Talc, steatite, soapstone, pyrophyllite	18,399	18,892	Austria 11,756; France 3,494; Belgium-Luxembourg 1,389.

See footnotes at end of table.

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Table 3.—Italy: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Other:			
Crude:			
Meerschaum, amber, jet	37	NA	
Other	55,457	64,459	U.S.S.R. 14,022; Republic of South Africa 10,557; Greece 9,421.
Slag, dross, and similar waste, not metal bearing	13,840	17,344	Austria 4,524; France 4,216; Algeria 2,617.
Oxides and hydroxides of magnesium, strontium, barium	2,588	758	United States 279; France 166.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	14,898	21,374	France 5,256; Yugoslavia 3,515; Austria 3,012.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,880	1,140	United States 893.
Carbon black and gas carbon	21,364	22,286	France 12,576; Federal Republic of Germany 3,142; Netherlands 2,351.
Coal, including briquets:			
Anthracite and bituminous coal thousand tons	12,280	11,736	Poland 3,246; United States 2,649; Federal Republic of Germany 2,578.
Briquets of anthracite and bituminous coal	25,158	1,187	NA.
Lignite and lignite briquets	85,696	64,847	Federal Republic of Germany 32,165; Yugoslavia 25,501.
Coke and semicoke	170,453	128,430	France 71,990; Federal Republic of Germany 39,292; Yugoslavia 10,189.
Gas, natural:			
Gaseous million cubic feet	397,738	410,132	U.S.S.R. 256,907; Netherlands 153,221.
Liquefied thousand 42-gallon barrels	23,445	19,845	Mainly from Libya.
Peat	52,337	34,330	U.S.S.R. 21,094; Federal Republic of Germany 9,588; Poland 1,777.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	735,871	787,215	Saudi Arabia 172,494; Iraq 139,008; Libya 113,099.
Refinery products:			
Gasoline do	15,862	16,187	Saudi Arabia 3,042; U.S.S.R. 2,951; Libya 1,790.
Kerosine do	751	1,592	Libya 786; Trinidad and Tobago 209; U.S.S.R. 181; Iraq 111.
Distillate fuel oil do	7,411	9,222	U.S.S.R. 3,774; Yugoslavia 2,321; Bahamas 866.
Residual fuel oil do	44,497	43,592	Venezuela 9,587; Greece 4,988; U.S.S.R. 3,915; Kuwait 3,779.
Lubricants do	671	572	Federal Republic of Germany 101; United Kingdom 82; United States 79.
Other:			
Liquefied petroleum gas do	2,883	2,985	Venezuela 410; Federal Republic of Germany 392; Hungary 276.
Mineral jelly and wax do	290	285	Federal Republic of Germany 100; Hungary 57; France 21.
Bitumen and other residues do	2,027	966	United States 750; Albania 215.
Bituminous mixtures, n.e.s do	15	10	France 5; Belgium-Luxembourg 1; Sweden 1.
Petroleum coke and pitch do	3,795	3,496	United States 2,104; United Kingdom 358; Federal Republic of Germany 192.
Total do	78,212	78,907	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	281,859	313,065	United States 205,451; Hungary 17,187; Romania 12,029.

NA Not available.

[1] Includes columbium and tantalum ores and concentrates, if any.

[2] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—During 1978 and 1979, Italy remained a large processor of imported bauxite and a significant producer of aluminum. The management of Euroallumina was planning to double capacity of its 1-million-ton-per-year alumina plant at Porto Scuso in Sardinia. Most of the new output will be reexported. In addition, plans were made to expand the 36,000-ton-per-year aluminum plant at Fusina, near Venice, operated by Alumetal SpA. New capacity should reach 70,000 tons per year of aluminum metal.

The Government of Italy has provided some 117,000 million lire to assist the state-owned sector of the aluminum industry. The largest part will be needed by the Alsars (Aluminio Sardo SpA) plant at Porto Vesme, Sardinia, where about 40% of its losses resulted from high prices for electricity. During 1978 and 1979, six aluminum smelters were in operation in the country with an aggregate capacity of 286,000 tons per year of aluminum metal. The largest plant was the smelter at Porto Vesme (capacity, 125,000 tons per year).

Bauxite for production of alumina was all imported. The small domestic production of around 35,000 tons from Amplamento Cavone mine, Poggiardo, Palmariggi, and Otranto, all in the Puglia region, mostly was used for cement production.

Iron Ore.—Domestic output of iron ore supplied only about 2% of the country's requirements, and imports were essential to meet the demand. The Cogne mine near Aosta, operated by the Cogne Steel Plant, and facilities on the Isle of Elba (Rio Marina plant), operated by Italsider, were the principal producers of iron ore. In addition, about 360,000 tons of iron pellets (65% iron) were produced at Scarlino from pyrite cinder left after production of sulfuric acid from pyrite.

Iron and Steel.—Performance of the iron and steel industry of Italy was modest during 1978 and 1979, and the Italian steel industry's prospects remained gloomy. Lower demand, lack of capital for needed improvement, structural problems of the industry, and poor performance of state-owned companies when compared with the private sector hampered operations.

During 1978, a new steel plan was made public by the Government. The plan calls for a steel output of about 25 million tons in 1980 and 31 million tons in 1985. The plan was considered optimistic and aroused some controversy. In addition, the steel sector was identified as needing reorganization.

The new 115-ton arc furnace at Italsider's Genova-Campi Works, rated at 250,000 tons per year of steel, was near completion at yearend 1978; it will replace two 100-ton open hearths.

The Gioia Tauro integrated steel plant project, in Calabria, was abandoned. The finances saved apparently will be used for modernization of Italsider's plant near Genova.

About 48% of Italian steel was produced in electric furnaces, 45% by Linz-Donawitz (LD) converter, and the rest by open hearth. Approximate capacity utilization was 68%, and the pig iron/steel ratio was 49/100.

The Finsider holdings, through which most of the Italian Government's activities in the iron and steel sector are exercised, produced about 55% of the Italian steel output. Among these holdings, Italsider was the largest Government-owned steel producer; Acciaierie e Ferriere Lombarde Falck remained the largest privately owned steel producer in the country.

During 1978 and 1979, most steelmaking raw materials were imported. In foreign trade in steel products, Italy registered a surplus during 1979.

Lead and Zinc.—Italy remained a net importer of lead and zinc metals during 1978 and 1979. Italy's output of lead metal supplied about 20% of the country's needs, but domestic production of zinc supplied about 73% of the demand for zinc metal. Activities of the mining and metal sectors of the industry were subdued and no major events, by world standards, were recorded. At Monteponi mine in Sardinia, operated by SAMIM, exploration on level 60 North resulted in discovery of significant mineralization. Details such as grade of ore and reserves were not made public at yearend 1978. During 1979, preparation for production from this section was underway.

In the area of Genna Luas, opencast mining started. Reserves of the Meteponi mine were increased from 1.8 to 2.1 million tons. At the San Giovanni e Arenas mine operated by Piombo Zincifera Sarda SpA, opencast mining continued in the Arenas section, and exploration was underway in Pinna Perda under the mineralized zones already mined out. Mining at SAMIM's nearby Finice Capanne mine stopped at the beginning of 1979 because the deposit was exhausted. In 1978 mining operations were suspended at Buggeraeu Suzufuru, operated by Piombo Zincifera Sarda SpA, owing to charges by local authorities of excessive pollution of the sea.

The Italian Government would like to close three obsolete zinc smelters formerly belonging to EGAM (Ponte Rosa, Porto Marghera and Monteponi) and expand capacity at Porto Vesme, which was operated by Azienda Mineraria et Metalurgica Italiane Sarda SpA (Ammi Sarda SpA), to 75,000 tons per year. Final action on closing of plants was delayed because of the social

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and economic consequences of such a closure on the regional economy. Expansion of the Crotone zinc electrolytic plant, operated by Pertusola, continued during 1978-1979.

Pyrites.—During 1978 and 1979, development of the Campiano mine in Tuscany by Solmine SpA continued after it had been dewatered. According to reports, labor shortages at the Nicoleta and Govorano pyrite mines, also in Tuscany and operated by Solmine, caused significant losses of production.

NONMETALS

Fluorspar.—In 1978 a decision was made to start development of a mine and construction of a commercial metspar plant based on the Pianciano fluorspar deposit owned by Soricom SpA, a wholly owned subsidiary of the Australian company, Southland Mining Ltd. The deposit is located in the province of Lazio, about 34 kilometers northwest of Rome, and consists of soft pyroclastic, lacustrius, muds and sands deposited around the Sabatino volcano. Thickness of the seams varies, but the problems are minimized by flatness of the beds and ease by which the deposit can be mined by opencast mining methods. Sandy and clayey ore makeup the producing zone. The clayey ore is extremely fine grained with an average fluorspar content close to 56%. The sand ore is mostly calcite, and its fluorite content is about 21%. Reserves were assessed at 5.8 million tons of sandy ore. By blending the two ores, Soricom intended to ship to the mill ores averaging 44% of fluorite.

Pianciano ore is very fine, and special processing, based on a flow sheet prepared by the Bureau de Recherches Geologiques et Minière (BRGM), had to be developed. Economics are most favorable at production of 200,000 tons of pellets containing about 80% fluorspar. Startup for the plant was planned for 1980.

Italy was self-sufficient in fluorspar; imports and exports were of the same order of magnitude. Most fluorspar to date has been produced on the island of Sardinia and in Lombardy.

Potash.—Mining of potash in Sicily was to be concentrated in the next few years into three large units where the 150,000,000 tons of known reserves are concentrated. These are Pasquasia, east of Caltanissetta, which began production in 1964; Realmonte, a salt mine west of Porto Empedocle, which has recently been developed to produce potash from one area; and Milena, a new mine near the San Cataldo/Palo mine, on which development for a production of 500,000 tons per year of ore was to begin in 1978.

Mines and plants in operation in Sicily in 1978 and 1979 are listed in the following tabulation:

	Location	Apparent capacity, tons per year		Remarks
		Ore	K_2O	
MINE				
Pasquasia	10 kilometers east of Caltanisetta.	1,000,000	NA	
Cervillo	Villarosa, West of Enna.	200,000		Ore to Pasquasia.
San Cataldo/Palo	San Cataldo	400,000		Almost exhausted.
Racalmuto	Racalmuto	400,000		Ore to San Cataldo.
Realmonte	Realmonte, West of Porto Empedocle.	200,000		
REFINING PLANTS				
Pasquasia	At mine	NA	130,000	
Campofranco	do	1,500,000	100,000	Feed via tram from San Cataldo/Palo, Racalmuto, and Realmonte.

NA Not available.

All Sicilian potash is kainite, which is converted to the salable product, potassium sulfate, at the two plants at Pasquasia and Campofranco. Production in 1978 and 1979 declined somewhat. All potash mines (except Realmonte, the salt and potash producer) were operated by Industria Sali Potassici el Afini (ISPEA), a company controlled by

Ente Minerario Siciliano, the Sicilian Government mining entity (60.7%); Montedison, the Italian chemical company (33.3%); and ENI, the nationalized petroleum company (6%).

Salt.—In 1978 a new salt refining plant came onstream at the Petralia Mine in Sicilia. At the port town of Empedocle, a second facility for loading salt was completed with a capacity of 100 tons per hour.

MINERAL FUELS

During 1978 and 1979, Italy remained totally dependent on imported solid liquid and gaseous hydrocarbons. Natural gas was the principal fuel produced in the country.

Coal.—Lignite was the only coal produced in Italy. Two mines, Santa Barbara and Pietrafitta, both in Perugia, were in operation. They were operated by Ente Nazionale Elettrico (ENEL), and all output was consumed in ENEL's power plants. Imports of bituminous coal, mostly for coking, were essential for operating the country's economy.

Natural Gas.—Italy was dependent on imports to supplement limited domestic production of natural gas. Italy had in force four long-term gas supply contracts at the end of 1979. The Libyan Government assures delivery of 10 million cubic meters per day of gas by tankers in the form of liquefied natural gas (LNG). The contracts with the U.S.S.R. and the Netherlands provide for deliveries of 20 million cubic meters per day through pipelines from each country. Supplies from Algeria should become significant in the future. During 1978, ENI and Sonatrach of Algeria signed a contract for construction of a 2,500-kilometer-long pipeline from the Algerian gasfields of Hass' R'mel, through Tunisia, under the Sicilian Channel, and across Sicily for connection with the domestic natural gas pipeline system. The pipeline will supply 12 billion cubic meters per year for a period of 25 years starting in 1981, at a total price of approximately $13.6 billion. The contract price is $1.28 per million BTU, very close to the current Algerian $1.30 base price for LNG contracts with other customers. The 100-mile-long segment underwater from Tunisia to Sicily, will be 16 inches in diameter, and the Italian firm, Snamprogetti, was to be the builder. Total pipeline costs were estimated at close to $3.4 billion. Construction started during 1979.

Imports will supply about 70% of Italy's domestic requirements by 1985, shown as follows:

	Quantity (billion cubic meters)	Total demand (percent)
Natural gas:		
Algeria	12.0	30.0
U.S.S.R	7.5	17.5
Netherlands	6.3	15.0
LNG: Libya	3.2	7.5
Total	29.0	70.0

Petroleum.—Exploration for hydrocarbon continued offshore and onshore and was moderately successful. Several discoveries were announced during 1978 and 1979, and these discoveries should slightly and temporarily improve the modest domestic share of Italy's energy supply. Positive results in exploration have given the proponents of domestic activities more arguments for continued drilling in the country.

A new draft bill, aimed at encouraging exploration in Italy, was pending in the Parliament at yearend. One major provision of the bill would encourage formation of joint ventures for oil exploration. The draft bill would also reduce royalties and taxes on offshore production, simplify administrative procedures for processing of exploration permits, allow oil exploration companies to reduce or enlarge concessionary areas depending on drilling results, and provide longer term concessions in the event new and more time-consuming technologies were employed to explore for oil. A major controversial item which might hold up the draft legislation is a provision which would reallocate at least part of all gas production (now reserved to ENI's distribution network) to the major petroleum companies for use in their own marketing channels.[3]

AGIP, a wholly owned subsidiary of state-owned ENI, announced an oil discovery at Cavone, about 25 kilometers north of Modena. The third well in the area was an oil producer from depths of 3,000 meters. Drilling in this area was part of ENI's intensive deep exploration program in the Po Valley. Reportedly, the oil has a density of 24° API and contains 2.5% sulfur. Reports indicated a peakout production of 1 million tons per year.

Total offshore concessions now cover 20,000 square miles of the 34,000 square miles available in Italy, of which AGIP holds approximately 10,000 square miles. To date, 32 deposits (results of 235 wells) have been discovered offshore with petroleum

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and gas reserves estimated at 75-100 million tons oil equivalent. Elf and Total of France and Exxon have already announced intention to drill in the area. Exxon's request is particularly noteworthy since it previously had never actively explored for hydrocarbons in the Italian waters.

Montedison SpA, Italy's biggest chemical group, confirmed discovery of oil in a field 6 kilometers offshore of Marina di Ragusa, Sicily, at a depth of 3,500 meters. Further drilling was needed to determine the size of the field and its commercial value.

AGIP began exploration in deep-water zone F, encompassing the continental shelf in the southern Adriatic and Ionian Seas. This zone was opened for preliminary research to the ENI group 3 years ago. AGIP was granted nine exploration permits for approximately 6,700 square kilometers, or 25% of the area. The remaining 75% was opened to private oil companies.

In the northern part of the Adriatic, a consortium made up of AGIP (Italy), Elf (France), and Ina-Naftaplin (Yugoslavia), was drilling offshore Trieste. At the beginning of 1979, the well was 6,500 meters deep and had reached Triassic formations, which are producers in deep zones of the Valley of Po.

Production of crude oil in Italy was hardly more than symbolic (1 million tons) when compared with demand of over 110 million tons; no substantial oil reserves are known in Italy, and the country was heavily dependent on imports.

At the beginning of 1979, there were 29 refineries in operation in Italy with an installed capacity of 160 million tons per year. Imports of crude were over 103 million tons. Saudi Arabia (30%), Iran (14%), Iraq (14%), and Libya (13%) were the largest suppliers of crude oil to Italy.

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[1] Physical scientist, Branch of Foreign Data.

[2] U.S. Department of State Airgram A-190, Oct. 18, 1978, p. 2.

[3] U.S. Embassy, Rome. U.S. Department of State Telegram 17643. Jan. 1979, p.1.

The Mineral Industry of Japan

By Edmond Chin[1]

Following the world oil crisis in 1973, Japanese industries entered a period of adjustment by retiring excess and unprofitable capacity, reducing manpower, liquidating debts, and promoting energy conservation. Japan is highly reliant on imported energy; in fact, 90% of its primary energy needs are met by imports. The dependence is the highest among the industrialized countries of the world. Despite energy dependence and attendent imported inflation due to rapid, incremental oil price increases, Japan's economy rebounded sharply in 1974-75 and stabilized in 1976-79.[2] In terms of current prices, Japan's gross national product (GNP)[3] increased from $692.2 billion[4] in 1977 to $976.4 billion in 1978 and reached $1,031.9 billion in 1979. At constant 1970 prices, GNP in 1977 was $391.7 billion; in 1978, $531.6 billion; and in 1979, $551.0 billion.

Even with a strong industrial base, Japan continued to be buffeted by higher oil prices ($13 per barrel in December 1978 compared with $27 per barrel in December 1979), deteriorating balance of payments, currency fluctuations, and mounting strain with trade-partner countries.

During 1978, the dollar slumped to Y175.50 on October 31 but rose to Y200 on December 1. During 1979, the rate rose to Y210 on April 2, Y220 on May 1, and Y250 on November 27. As a result of the weakened yen and higher crude oil prices, the wholesale price index for all commodities increased 7.3% compared to an increase of 3.5% of the consumer index. To thwart imported inflation, the Bank of Japan raised the official discount rate to tighten credit in 1979. Effective April 17, the official rate was increased by 0.75% to 4.25%; effective July 24, 5.25%; and effective November 2, 6.25%.

Because of worldwide recession, Japanese industries had reduced their operating rate to about 80%. To cope with low economic growth, industry retrenchment helped to reduce overall costs and debts to lower the break-even point for profits. The Government had promoted public work projects in 1977-78 to stimulate business and had lowered the prime discount rate to alleviate the burden of interest rates on business enterprises and industry. In 1979, demand was on an upswing, and along with prior plant and equipment investments, industry was able to increase operating rates and also to increase profits. By mid-1979, the steel industry, automotive makers, petroleum refiners, and electrical and heavy machinery manufactures were having pretax profits. On the other hand, the construction industry continued its slump as a result of slowed Government orders, which was followed by deteriorating earnings by the cement producers. The power utility industry was increasingly affected by the markups in oil prices and the declining value of the yen; pretax profits in this sector fell close to 70% in 1979.

Despite fiscal and monetary controls, Japanese commodity prices fluctuated widely during 1979. According to the Nikkei index of commodity prices (based on 17 items), there was a 21% rate in fluctuation between the high and low price in 1979, compared with 8% in 1978. The largest upswing in price was naturally for petroleum products (gasoline, kerosine, and fuel oil), which had a 79% fluctuation rate; followed by nonferrous metals, 52%; construction materials, 38%; and chemicals, 35%. The commodities least sensitive to price fluctuations during the year were steel and textiles.

Japan's labor unemployment problems were recovering from the prolonged recession. At the beginning of 1979, there were

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two applicants for every job offer. By the end of the year, the ratio was reduced to five applicants for four jobs. It was expected that unless the economy suddenly declined, there would be a favorable upturn in employment in 1980 as industry increased recruitment for new employees. During the fall of 1979, the steel industry had agreed to extend the mandatory retirement age from 55 years to 60 years starting in 1981. The Ministry of Labor was working on a policy to set mandatory retirement at 60 years in 1985. Companies which had set mandatory retirement at 55 years were reviewing wages and personnel management, inasmuch as a seniority-based wage system increases personnel costs by extending the retirement age. In 1979, the wholly unemployed in Japan numbered 1.1 million, and the unemployment rate was slightly above 2%.

Japanese exports reached $100 billion in 1979.[8] Growth in exports was boosted by shipments of cement and steel to the Middle East, especially Iraq, Kuwait, and Saudi Arabia, and Japanese products to China. Significantly, the higher labor costs and inflation in South Korea and Taiwan enabled some Japanese products to regain price competitiveness in foreign markets.

At the end of fiscal year (FY) 1977 (March 1978), Japan's balance of payments surplus was $13.9 billion. By the end of FY 1978, there was a deficit of $7.6 billion. The FY 1979 deficit was estimated between $11.3 billion and $14.1 billion. The main cause of the downturn was that exports did not grow under the higher value of the yen while import payments increased drastically owing to demand and the oil price hikes. Estimates by financial institutions and economic research centers of the deficit in the balance of current accounts in FY 1979 ranged from $11.3 billion to $14.1 billion, and for FY 1980 from $2.4 to $14.9 billion.

Japan ranks fourth after the United States, the United Kingdom, and the Federal Republic of Germany in overseas investments. Japan's outstanding balance reached $25.7 billion on an application-approval basis at the end of 1978. Authorized direct investments abroad reached $4.6 billion in FY 1978, surpassing the peak record of $3.5 billion in FY 1973. Investments in North America accounted for almost 25%, of which 90% was in the United States. Investments in Asia accounted for 30%, particularly in Hong Kong, Indonesia, and South Korea. The remainder was distributed in South and Central America, the Middle East, and Oceania. By types, service industries accounted for nearly 40% of total investments, followed by manufacturing, 36%; and resource development, 24%.

Japan's aid budget accounted for a little over 1% of the GNP, the pledged goal assessed by the Organization for Economic Cooperation and Development. Japan's economic cooperation in 1978 was as follows in percent: Asia, 31; Latin America, 30; Middle East, 26; Africa, 9; and all other, 4.

Domestic investment in research and development totaled Y4,045.5 billion in 1979, of which Y2,291 billion was contributed by industry. About 88.2% of the total research and development expenditure was in science and technology. Projects receiving the largest investments were nuclear energy, information processing, environmental protection, space research, and ocean development. Investments in these projects were estimated at Y456.3 billion in 1979, compared with Y546.2 billion in 1978.

Industrial plant contracts were estimated to have reached $11.4 billion in 1979. Most of the outstanding contracts with China became effective in 1979, amounting to about $3 billion; and new contracts were concluded with Middle East oil-producing nations, such as Iraq and Saudi Arabia. Factors contributing to brisk industrial plant sales included depreciation of the yen to the U.S. dollar, upgraded technological levels, confidence in Japanese expertise, and the Government's financing programs. Most of the sales currently centered around exports of large petroleum-related plant facilities to oil-producing countries, and industrial complexes to developing nations, such as the Baoshan iron and steel complex in China and desalination plants in Saudi Arabia.

Domestic orders for pollution control equipment totaled Y528,505 million in 1978 compared with Y490,000 million in 1977 and Y380,000 million in 1976. By type of pollution control, orders in water treatment accounted for 61.8% of total sales in 1978; air pollution, 17.2%; refuse, 20.5%; and noise and vibration, 0.5%. Overseas sales of pollution control equipment were negligible, accounting for a little over 6% in total orders.

In 1979, the Mitsubishi group of companies formed Ryowa Ocean Development Co. to explore ocean-bottom resources. Ocean Management, Inc., in which Sumitomo is a member, was preparing to enter commercial operations in mining manganese nodules in the seabed off Hawaii. Ocean Farm Study Group was studying the feasibility of using bacterial species to ferment seaweed to produce methane gas.

PRODUCTION

Japan is much more important as a consumer of raw materials for the production of diverse, large-volume intermediate and finished goods than as an ore producer. There is significant mine output of dolomite and seawater magnesia, iron ore, copper, lead and zinc, manganese, and salt.[6] However, large imports of mineral commodities are required to meet Japan's industrial needs to produce value-added goods. Some industries are almost wholly dependent on imported raw materials; for instance, the petrochemicals and aluminum sectors.

In terms of mineral and metal processing, Japan's industries are very prominent, and output of refined metals and mineral products is large by world standards. Japan ranks with the top 10 producing countries in output of aluminum, copper, iron and steel, and zinc metal; cement and fertilizers; and refined oil and petrochemicals. It is also a major producer of lesser minerals, metals, and products such as bismuth, indium, selenium, lime, magnesia, halogens, and industrial gases.

Table 1.—Japan: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]
METALS				
Aluminum:				
Alumina, gross weight	1,411	1,785	1,524	[1]1,546
Metal:				
Primary:				
Regular grades	919	1,188	1,057	[1]1,010
High purity	4	5	4	4
Secondary	526	575	635	600
Antimony:				
Oxide tons	5,901	5,571	6,000	6,000
Metal do.	2,207	1,302	1,000	1,000
Arsenic, white (equivalent of arsenic acid) do.	60	NA	NA	NA
Bismuth do.	681	698	615	635
Cadmium do.	2,500	2,844	2,530	3,000
Chromium:				
Chromite, gross weight do.	22,150	17,986	9,000	9,100
Metal do.	2,417	2,743	3,000	[1]3,000
Cobalt metal do.	([3])	--	--	[1]2,600
Columbium and tantalum: Tantalum metal do.	[r]46	[e]50	NA	NA
Copper:				
Mine output, metal content	82	81	73	[1]60
Metal:				
Blister and anode:				
Primary	770	848	854	861
Secondary	89	104	56	60
Total	[r]859	952	910	[1]921
Refined:				
Primary	770	849	854	850
Secondary	94	85	105	133
Total	864	934	959	[1]983
Germanium:				
Oxide tons	22	16	16	[1]15
Metal do.	16	13	11	[1]10
Gold:				
Mine output, metal content thousand troy ounces	138	149	145	[1]133
Metal do.	1,113	1,281	1,357	1,306
Indium metal do.	300	250	[e]200	200
Iron and steel:				
Iron ore and iron sand concentrate	758	684	596	456
Roasted pyrite concentrate (50% or more Fe)	653	571	487	[1]442
Metal:				
Pig iron and blast-furnace ferroalloys	86,576	85,886	78,589	[1]83,826

See footnotes at end of table.

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Table 1.—Japan: Production of mineral commodities —Continued

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979ᵖ
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Electric-furnace ferroalloys:				
Ferrochrome	464	399	274	[1]366
Ferromanganese	632	527	456	[1]468
Ferronickel	198	224	198	[1]304
Ferrosilicon	313	291	270	[1]330
Silicomanganese	373	334	308	[1]300
Other[3]	ʳ16	21	20	11
Steel, crude	107,399	102,405	102,105	[1]111,748
Semimanufactures, hot-rolled:				
Ordinary steels	83,161	79,617	79,625	80,000
Special steels	9,885	10,304	11,669	12,000
Lead:				
Mine output, metal content	52	55	57	[1]47
Metal, refined:				
Primary	219	221	194	[1]221
Secondary	54	56	53	[1]52
Magnesium metal:				
Primary tons	11,190	9,416	11,000	[1]11,000
Secondary do	7,396	7,613	11,000	[1]12,000
Manganese:				
Ore and concentrate, gross weight	142	126	107	[1]89
Oxide	33	29	31	[1]36
Metal tons	6,752	7,267	6,463	7,000
Molybdenum:				
Metal content of concentrate do	220	182	126	[1]137
Metal do	336	275	309	[1]408
Nickel metal:				
Refined do	24,010	24,139	21,636	25,081
Ni content of ferronickel do	70,790	69,761	57,564	75,969
Total do	94,800	93,900	79,200	101,000
Platinum-group metals:				
Palladium metal troy ounces	18,069	22,716	23,985	24,000
Platinum metal do	8,706	9,737	10,100	10,200
Rare-earth metals:				
Lanthanum oxide tons	80	109	97	100
Cerium metal do	301	NA	NA	NA
Selenium, elemental do	460	456	478	450
Silicon metal do	283	289	274	280
Silver:				
Mine output, metal content thousand troy ounces	9,299	9,646	9,645	8,665
Metal, primary do	36,522	38,184	38,774	39,025
Tellurium, elemental tons	ʳ38	65	74	77
Tin:				
Mine output, metal content do	ʳ643	604	598	600
Metal, smelter do	1,144	1,290	1,140	1,251
Titanium:				
Slag do	3,486	1,228	175	180
Metal do	6,346	6,395	9,174	13,490
Tungsten:				
Mine output, metal content do	ʳ810	768	761	770
Metal do	1,431	1,433	1,478	1,450
Uranium metal kilograms	3,043	ᵉ3,000	NA	NA
Zinc:				
Mine output, metal content	260	276	275	[1]243
Oxide	59	58	58	[1]61
Metal:				
Primary	742	778	768	[1]757
Secondary	34	26	25	[illegible]
NONMETALS				
Asbestos	8	7	7	[illegible]
Barite	54	56	74	73
Bromine, elementalᵉ	12	12	12	12
Cement, hydraulic	68,712	73,138	84,868	87,094
Clays:				
Bentoniteᵉ	400	400	400	400
Fire clay	891	902	559	600
Kaolin	226	227	227	227
Feldspar and related materials:				
Feldspar	41	42	42	41
Aplite	358	395	382	[1]395
Gypsum	ʳ3,367	3,583	4,155	4,300

See footnotes at end of table.

Table 1.—Japan: Production of mineral commodities —Continued

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]
NONMETALS —Continued				
Iodine, elemental ... tons	6,954	6,100	6,000	6,250
Lime: Quicklime	9,176	9,022	9,058	[1]9,628
Nitrogen, N content of ammonia	[2]2,236	2,292	2,454	2,190
Perlite ... tons	65,000	70,000	73,000	75,000
Salt, all types	1,021	1,056	1,073	1,100
Sodium compounds, n.e.s.:				
Sodium carbonate	1,085	1,179	1,162	1,200
Sodium sulfate	313	324	321	330
Stone, crushed and broken:				
Dolomite	5,524	5,752	6,087	6,000
Limestone	147,530	154,507	172,673	165,000
Sulfur:				
S content of pyrite	471	389	327	330
Byproduct:				
Of metallurgy	1,252	1,336	1,296	1,350
Of petroleum	925	1,100	1,104	1,100
Talc and related materials:				
Talc	105	128	141	130
Pyrophyllite	1,692	1,671	1,131	1,300
Vermiculite[e] ... tons	13,000	14,000	15,000	16,000
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	409	[e]425	489	[1]538
Coal:				
Anthracite	38	--	--	[1]23
Bituminous coal[4]	18,359	18,200	18,992	[1]17,639
Lignite	53	[e]40	39	[1]32
Total	18,450	18,240	19,031	[1]17,694
Coke, including breeze:				
Metallurgical	43,446	[e]43,000	40,546	[1]43,189
Metallurgical breeze	2,181	[e]2,000	[e]2,000	2,000
Gashouse, including breeze	4,131	[e]4,000	3,342	[1]3,226
Fuel briquets, all grades	466	[e]450	421	[1]479
Gas, natural:				
Gross[e] [5] ... million cubic feet	101,000	110,000	105,000	100,000
Marketed ... do	99,720	108,945	102,909	[1]95,632
Natural gas liquids:				
Natural gasoline ... thousand 42-gallon barrels	37	[e]37	[e]37	37
Liquefied petroleum gas from natural gas (field plants only) ... do	293	[e]300	[e]300	300
Peat[e]	70	70	60	60
Petroleum:				
Crude ... thousand 42-gallon barrels	4,241	4,334	3,963	[1]3,522
Refinery products:				
Gasoline:				
Aviation ... do	198	157	170	[1]138
Other ... do	[r]189,530	196,317	209,449	[1]215,910
Jet fuel ... do	22,102	24,077	26,074	[1]26,669
Kerosine ... do	151,567	183,405	187,073	[1]193,537
Distillate fuel oil ... do	230,939	114,870	122,975	[1]135,652
Residual fuel oil ... do	674,246	808,850	780,226	[1]779,628
Lubricants ... do	13,713	14,221	11,440	[1]12,277
Other:				
Asphalt and bitumen ... do	24,972	28,103	31,219	[1]30,618
Liquefied petroleum gas ... do	50,592	37,135	48,645	[1]52,413
Naphtha ... do	180,897	126,796	120,057	[1]118,563
Paraffin ... do	885	1,132	1,088	[1]1,195
Petroleum coke ... do	1,143	1,730	440	[1]503
Unfinished oils ... do	47,489	44,224	38,300	[1]45,362
Refinery fuel and losses ... do	92,353	125,446	110,768	[1]83,441
Total ... do	1,680,626	1,701,463	1,687,924	1,695,906

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] Reported figure.

[2] Revised to none.

[3] Includes (but not limited to) ferromolybdenum, ferrotungsten, ferrovanadium, and silicochromium.

[4] Includes a small amount of natural coke.

[5] Includes output from gas mines and coal mines.

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TRADE

During the past decade, Japan's total trade grew from Y11.2 trillion in 1969 to Y46.8 trillion in 1979. Japan had a deficit trade balance for the years 1973-75 and for 1979. Total exports in 1978 and 1979 were Y20.6 trillion and Y22.5 trillion, respectively; corresponding imports were Y16.7 trillion and Y24.6 trillion, respectively. The United States continued to be Japan's major trading partner, with 22% of total Japanese trade in 1979. Exports to the United States were valued at Y5.8 trillion, compared with Y4.6 trillion for U.S. shipments to Japan in 1979. Other major trading partners in 1979 were as follows, in order of total trade expressed in billion yen: Republic of Korea, 2,091; Australia, 1,948; Federal Republic of Germany, 1,497; Taiwan, 1,493; China, 1,452; United Kingdom, 1,041; U.S.S.R., 954; and Hong Kong, 950.

Receipts of mineral fuels, valued at Y9,986.9 billion in 1979, were by far the highest valued import class. Imports of crude oil alone were over Y7,165.7 billion. Imports of nonmetallic and metal ores were Y171.1 billion and Y1,292.6 billion, respectively. The value of imports of base metals and semimanufactures were as follows in billion yen: Iron and steel, 333.5; copper, 181.9; nickel, 66.2; aluminum, 278.9; magnesium and beryllium, 6.8; lead, 16.5; zinc, 6.9; and tin, 98.7.

In comparison, total exports of metals and semimanufactures totaled Y4,036.1 billion, of which shipments of iron and steel comprised 88% of the total value. Other major export categories included mechanical and electrical appliances and equipment, Y6,084 billion; transport vehicles and equipment, Y5,868 billion; and chemicals, Y1,084 billion.

Table 2.—Japan: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite and concentrate	660	1,821	Republic of Korea 1,800.
Oxide (alumina) and hydroxide thousand tons	203	175	Austria 63; Republic of Korea 57.
Fused alumina (artificial corundum)	11,175	12,949	Republic of Korea 6,798; Taiwan 4,472.
Metal including alloys, all forms thousand tons	193	205	United States 60; Republic of Korea 46; Iran 19.
Arsenic trioxide, pentoxide, acids	12	6	Republic of Korea 3; Taiwan 3.
Beryllium metal including alloys, all forms kilograms	223	237	All to Taiwan.
Bismuth metal including alloys, all forms	302	288	United States 170; U.S.S.R. 35; Netherlands 34.
Cadmium metal including alloys, all forms	784	111	United Kingdom 69; India 17; Taiwan 16.
Chromium:			
Chromite	2,805	1,636	Republic of Korea 1,618.
Oxide and hydroxide	2,033	1,562	United States 594; Taiwan 445; Republic of Korea 343.
Cobalt oxide and hydroxide thousand tons	10	87	Netherlands 41; West Germany 35.
Columbium and tantalum: Tantalum metal including alloys, all forms kilograms	45,469	41,290	West Germany 36,339.
Copper:			
Copper sulfate	560	325	Taiwan 214; Thailand 50.
Metal including alloys, all forms thousand tons	224	244	Taiwan 42; United States 39; Republic of Korea 33.
Iron and steel:			
Ore and concentrate	12	18	All to Taiwan.
Metal:			
Scrap	210,740	164,395	Republic of Korea 118,781; Hong Kong 33,466.
Pig iron, including cast iron[2]	563,911	32,678	Vietnam 16,300; Pakistan 11,000.
Sponge iron, powder, shot	10,602	10,585	Taiwan 2,267; Republic of Korea 2,259; Australia 1,456.
Ferroalloys:			
Ferromanganese thousand tons	49	37	China, mainland, 28.
Other do	27	31	United States 20; Netherlands 7.
Steel, primary forms do	4,659	4,428	Republic of Korea 1,007; China, mainland, 716; United States 465.

See footnotes at end of table.

Table 2.—Japan: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Semimanufactures:			
Bars, rods, angles, shapes, sections thousand tons	7,571	6,166	China, mainland, 1,354; United States 1,195.
Universals, plates, sheets:			
Uncoated universals, plates, sheets do	10,999	10,372	China, mainland, 1,825; United States 950; Republic of Korea 651.
Tinned plates and sheets do	908	815	United States 200; China, mainland, 94; Philippines 62; U.S.S.R. 52.
Other coated plates and sheets do	2,580	2,315	United States 1,074.
Hoop and strip do	1,006	812	China, mainland, 163; Indonesia 67; Iran 66.
Rails and accessories do	218	193	China, mainland, 48; Brazil 43; United States 10.
Wire do	456	367	United States 191.
Tubes, pipes, fittings do	5,206	6,280	United States 1,403; U.S.S.R. 1,126; China, mainland, 566.
Castings and forgings, rough do	30	31	United States 17.
Lead:			
Ore and concentrate	6,954	9,312	United States 4,012; U.S.S.R. 4,000.
Oxide	388	1,021	Tanzania 300; Republic of Korea 158.
Metal including alloys, all forms thousand tons	12	10	Republic of Korea 6.
Magnesium metal including alloys, all forms	405	313	Republic of Korea 155; India 60; North Korea 60.
Manganese:			
Ore and concentrate	5,206	4,831	Republic of Korea 2,691; Burma 540.
Oxides thousand tons	24	22	United States 4; Republic of Korea 3; Indonesia 2.
Mercury 76-pound flasks	2,299	6,929	United States 4,341; Republic of Korea 961; Taiwan 651.
Molybdenum metal including alloys, all forms	43	39	Hungary 17; Republic of Korea 6; China: Mainland 5 and Taiwan 4.
Nickel:			
Ore and concentrate	30	--	
Metal including alloys, all forms	6,083	5,242	India 1,565; United States 524; Australia 411; Brazil 351.
Phosphorus, elemental (red)	98	148	Taiwan 44; India 34; Vietnam 30.
Platinum-group metals and silver:			
Waste and sweepings	5	15	All to Republic of Korea.
Metals including alloys:			
Platinum-group thousand troy ounces	^{r}122	123	Taiwan 80; Republic of Korea 23.
Silver do	2,343	3,015	Republic of Korea 1,115; United States 945; Taiwan 769.
Selenium, elemental	296	264	Netherlands 94; United Kingdom 62; United States 48.
Tin:			
Oxides	3	11	United States 5; Thailand 3.
Metal including alloys, all forms	^{r}942	487	Republic of Korea 84; Taiwan 21.
Titanium:			
Oxide thousand tons	18	11	Taiwan 4; Republic of Korea 2; United States 1.
Metal including alloys, all forms	2,312	4,176	United Kingdom 1,463; West Germany 963; United States 843.
Tungsten metal including alloys, all forms	130	172	Malaysia 38; Austria 36; United States 20.
Zinc:			
Oxide	1,761	1,322	Taiwan 424; Republic of Korea 306; Burma 236.
Metal including alloys, all forms thousand tons	77	67	Republic of Korea 20; United States 12; Taiwan 11.
Other:			
Ores and concentrates:			
Of molybdenum, tantalum, titanium, vanadium, zirconium	678	1,398	Republic of Korea 1,005.
Of base metals, n.e.s	5	153	Romania 150.
Ash and residue containing nonferrous metals	6,279	5,123	United Kingdom 1,067; United States 1,028.
Oxides, hydroxides, peroxides of metals	1,361	2,164	Republic of Korea 556; Taiwan 325; Indonesia 305; United States 291.

See footnotes at end of table.

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Table 2.—Japan: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Other —Continued			
Metals including alloys, all forms:			
Phosphorus and other metalloids	246	149	Republic of Korea 68; Malaysia 22; United States 15.
Alkali, alkaline-earth, rare-earth metals	292	688	Taiwan 398; United States 174; West Germany 74.
Pyrophoric alloys	76	81	France 30; United States 22.
Base metals including alloys, all forms, n.e.s.	5,982	7,236	United States 2,434; Belgium-Luxembourg 561; German Democratic Republic 555.
NONMETALS			
Abrasives, natural, n.e.s.:			
Emery	1,134	1,429	Taiwan 639; Republic of Korea 491.
Dust and powder of precious and semiprecious stones thousand carats	1,111	1,168	United States 564; Republic of Korea 474; Taiwan 117.
Grinding and polishing wheels and stones	4,721	4,868	United States 569; Thailand 567; Hong Kong 505.
Other	147	416	Republic of Korea 304; Taiwan 38; Malaysia 32.
Asbestos	1,226	756	Taiwan 365; Republic of Korea 297.
Barite and witherite	1,250	2,894	U.S.S.R. 2,889.
Boron materials:			
Crude natural borates	17	285	Republic of Korea 275.
Oxide and acid	382	120	Taiwan 71; Republic of Korea 37.
Cement thousand tons	6,683	8,624	Saudi Arabia 2,032; Singapore 1,120; United States 1,042.
Chalk	17	50	Singapore 40.
Clays and clay products (including all refractory brick):			
Crude	53,360	64,171	Taiwan 37,920; Republic of Korea 11,454.
Products:			
Refractory	165,203	167,655	Republic of Korea 51,668; Taiwan 21,361.
Nonrefractory[3]	55,410	48,442	United States 15,419; Singapore 8,480; Hong Kong 5,893.
Cryolite and chiolite	2	--	
Diamond:			
Gem, not set or strung carats	798	232	Republic of Korea 230.
Industrial thousand carats	1	1	All to Republic of Korea.
Diatomite and other infusorial earth	1,024	1,298	China: Mainland 272 and Taiwan 466.
Feldspar, fluorspar, and related materials:			
Feldspar	11,224	15,157	Taiwan 13,869.
Fluorspar, leucite, nepheline, nepheline syenite	840	532	Vietnam 300; Cuba 100.
Fertilizer materials:			
Manufactured:			
Nitrogenous[4]	2,478	2,030	China, mainland, 1,215; India 98; Vietnam 86.
Phosphatic thousand tons	23	11	Burma 3; Fiji 2; Taiwan 2; Thailand 2.
Potassic do	2	4	All to Republic of Korea.
Other, including mixed do	43	64	Sri Lanka 25; Zambia 17.
Ammonia	242,768	201,108	Philippines 192,356.
Graphite, natural	1,311	1,406	Taiwan 929; United States 216.
Gypsum and plasters	6,474	6,172	Republic of Korea 2,238; Taiwan 2,047.
Kyanite and related materials	16,496	16,470	Taiwan 12,508; Republic of Korea 2,328; Thailand 1,161.
Lime	29,287	33,290	Papua New Guinea 23,600.
Magnesite	5,299	17	Thailand 10; Republic of Korea 7.
Mica	411	783	Taiwan 302; Hong Kong 287.
Pigments, mineral: Iron oxides, processed	12,554	15,589	Taiwan 6,452; United States 2,659; Republic of Korea 1,051.
Precious and semiprecious stones, except diamond:			
Natural kilograms	135,206	75,753	Republic of Korea 39,441; Taiwan 22,685.
Manufactured do	26,826	24,108	Republic of Korea 11,819; West Germany 5,035; United States 1,112.
Salt and brines	958	2,934	United States 1,169; Papua New Guinea 1,023.
Sodium and potassium compounds, n.e.s.:			
Caustic soda thousand tons	164	146	Australia 125; Republic of Korea 13; United States 6.
Caustic potash and sodic and potassic peroxides do	5	5	Australia 2; Republic of Korea 1; Taiwan 1.
Stone, sand and gravel:			
Dimension stone	[r]322	1,507	Republic of Korea 1,168.
Dolomite, chiefly refractory grade	6,340	5,399	Philippines 4,610; Taiwan 445.

See footnotes at end of table.

Table 2.—Japan: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Stone, sand and gravel —Continued			
Gravel and crushed rock	6,936	19,541	Australia 12,000; Republic of Korea 5,511.
Limestone, except dimension thousand tons	1,212	1,339	Australia 1,331.
Quartz and quartzite	478	568	Iran 133, Taiwan 110.
Sand, excluding metal bearing	1,813	6,956	Iran 2,759; France 1,222; Taiwan 749.
Sulfur:			
Elemental:			
Colloidal	519	220	Republic of Korea 156; Cuba 34; Iraq 15.
Other than colloidal	467,929	320,986	Republic of Korea 250,541; Taiwan 66,590.
Sulfur dioxide	20	66	Republic of Korea 28; Taiwan 22.
Sulfuric acid thousand tons	290	325	Philippines 107; Peru 48; Turkey 34; Spain 33.
Talc and steatite	1,721	1,803	Taiwan 609; Vietnam 430; Philippines 204.
Other:			
Crude thousand tons	9	10	Republic of Korea 4; Taiwan 2.
Slag, dross, and similar waste, not metal bearing do.	218	518	Republic of Korea 363; Philippines 81.
Oxides, hydroxides, and peroxides of magnesium, strontium, barium (including clinker) do.	145	149	Poland 30; Australia 25; United Kingdom 24.
Bromine, iodine, fluorine	5,484	6,020	United States 2,621; United Kingdom 682; France 605.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	9	7	Taiwan 6.
Carbon black and gas carbon:			
Carbon black thousand tons	23	31	China, mainland, 17; Indonesia 3; India 2.
Gas carbon	--	26	All to Kuwait.
Coal, all grades, including briquets thousand tons	32	48	Republic of Korea 25; North Korea 17.
Coke and semicoke do.	530	896	United States 304; Chile 129; Peru 106.
Gas, manufactured only	(5)	(5)	
Hydrogen and rare gases (helium, krypton, neon, xenon) do.	799	1,156	Taiwan 392; Iran 262.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	(6)	--	
Refinery products, nonbunker:			
Kerosine and jet fuel do.	7	1,508	Indonesia 974; India 363; Singapore 161.
Distillate fuel oil do.	5	503	Thailand 333; New Zealand 167.
Residual fuel oil do.	72	233	Republic of Korea 232.
Lubricants do.	2,066	2,350	Republic of Korea 847; Taiwan 276; Indonesia 250.
Other:			
Liquefied petroleum gas do.	40	282	Hong Kong 181; Philippines 80.
Naphtha do.	28	51	Taiwan 41.
Mineral jelly and wax do.	447	565	Mexico 63; Republic of Korea 62; Taiwan 48.
Petroleum coke do.	89	33	West Germany 30.
Bitumen do.	39	6	Indonesia 2; Republic of Korea 2.
Unspecified	r81	101	Republic of Korea 54; Taiwan 15; India 14.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand tons	78	149	NA.

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r Revised. NA Not available.

[1] Excludes exports under the Japanese-United States Mutual Defense Agreement and those for the account of the U.S. military forces.

[2] Includes spiegeleisen, if any.

[3] Excludes mosaic tile.

[4] Includes exports containing more than 45% N.

[5] Same as gas carbon.

[6] Less than 1/2 unit.

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Table 3.—Japan: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate thousand tons	5,318	4,743	Australia 3,245; Indonesia 990; Malaysia 417.
Oxide and hydroxide do	^{r}940	759	Australia 744.
Fused alumina (artificial corundum)	3,942	5,769	India 3,263; Austria 996; Brazil 970.
Metal including alloys:			
Scrap thousand tons	70	140	United States 108.
Unwrought do	534	740	Canada 124; New Zealand 121; Bahrain 113.
Semimanufactures do	23	26	Romania 7; France 2; United States 2; Yugoslavia 2.
Antimony:			
Ore and concentrate	7,501	6,553	Bolivia 4,699; Thailand 1,032.
Metal including alloys, all forms	1,239	1,611	China, mainland, 1,578.
Arsenic:			
Natural sulfides	4	10	All from China, mainland.
Trioxide, pentoxide, acids	1,076	755	France 430; China, mainland, 215; Sweden 101.
Beryllium metal including alloys, all forms kilograms	6,098	1,674	All from United States.
Chromium:			
Ore and concentrate thousand tons	900	670	Republic of South Africa 350; Philippines 74; India 73.
Oxide and hydroxide	3,061	3,505	United States 1,791; West Germany 789; U.S.S.R. 778.
Cobalt:			
Oxide and hydroxide	597	615	Belgium-Luxembourg 522; Canada 52.
Metal including alloys, all forms	2,083	1,351	Zaire 697; Belgium-Luxembourg 292.
Columbium and tantalum:			
Columbium (niobium) ore and concentrate	1,751	1,858	Canada 1,316.
Tantalum:			
Ore and concentrate	170	128	Malaysia 77; Australia 46.
Metal including alloys, all forms	47	46	United States 39.
Copper:			
Ore and concentrate thousand tons	2,823	2,818	Canada 821; Philippines 818.
Copper sulfate[2]	378	558	China: Mainland, 105 and Taiwan 158.
Metal including alloys:			
Scrap thousand tons	41	55	United States 31; Hong Kong 10.
Unwrought do	272	280	Zambia 89; Chile 64; Peru 55.
Semimanufactures	1,239	1,359	United States 826; Belgium-Luxembourg 108.
Germanium:			
Dioxide	8	12	West Germany 8; U.S.S.R. 4.
Metal including alloys, all forms kilograms	828	1	All from Belgium-Luxembourg.
Gold metal thousand troy ounces	1,661	3,167	Switzerland 1,886; United Kingdom 987.
Indium metal including alloys, all forms kilograms	1,262	2,774	United States 879; West Germany 577; Peru 527.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	132,571	114,645	Australia 52,626; Brazil 30,816; India 14,355.
Roasted pyrite	17,556	2,891	Philippines 2,800.
Metal:			
Scrap thousand tons	1,448	3,229	United States 2,691; Australia 172; U.S.S.R. 165.
Pig iron, including cast iron do	543	640	Canada 125; Mexico 94; Romania 78; Australia 71.
Sponge iron, powder, shot do	7	6	All from Sweden.
Ferroalloys do	191	361	Republic of South Africa 151; Brazil 44; Norway 30.
Steel, primary forms do	160	149	Romania 46; United States 46.
Semimanufactures do	36	24	Sweden 3; United States 3; United Kingdom 2.
Lead:			
Ore and concentrate do	194	222	Canada 154.
Oxides	511	766	Mexico 468; Bulgaria 239.
Metal including alloys:			
Scrap	2,856	6,704	United States 3,552; Canada 2,012.
Unwrought	32,075	59,341	North Korea 19,285; Mexico 10,135; Australia 7,534.
Semimanufactures	12	17	United States 15.
Magnesium metal including alloys, all forms	2,760	9,115	United States 5,954; Norway 1,571; Canada 996.
Manganese:			
Ore and concentrate[3] thousand tons	2,754	2,012	Republic of South Africa 698; India 458; Australia 444.

See footnotes at end of table.

Table 3.—Japan: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Manganese —Continued			
Oxides kilograms	685,323	39,512	United States 21,506; Belgium-Luxembourg 18,000.
Mercury 76-pound flasks	2,595	3,066	Algeria 2,365; Spain 600.
Molybdenum:			
Ore and concentrate	16,505	16,645	United States 8,473; Canada 6,322.
Trioxide	498	497	United States 428.
Metal including alloys, all forms	^{r}47	110	United States 95; West Germany 13.
Nickel:			
Ore and concentrate thousand tons	3,951	2,999	New Caledonia 1,545; Indonesia 823; Philippines 631.
Matte, speiss, similar materials do	41	30	Australia 22; Indonesia 7.
Metal including alloys:			
Scrap	3,883	3,522	United States 1,211; Taiwan 1,040; United Kingdom 861.
Unwrought	11,121	10,890	U.S.S.R. 2,404; Australia 2,376.
Semimanufactures	3,001	2,607	United Kingdom 975; United States 855; Canada 273.
Platinum-group metals:			
Waste and sweepings value	$96,510	$292,379	Taiwan $251,561; Hong Kong $20,844; Republic of Korea $19,974.
Metals including alloys, all forms:			
Platinum thousand troy ounces	1,170	1,231	Republic of South Africa 445; U.S.S.R. 410.
Palladium troy ounces	497,708	739,643	U.S.S.R. 557,103; Republic of South Africa 97,517.
Rhodium do	26,492	27,801	U.S.S.R. 12,906; Republic of South Africa 11,035.
Iridium, osmium, ruthenium do	11,276	19,731	Republic of South Africa 9,809; United Kingdom 6,374.
Alloys do	37.241	42,553	West Germany 27,827; United States 6,268.
Rare-earth metals:			
Oxides and crude chlorides[4]	2,068	1,588	India 700; France 326.
Metals (yttrium, scandium, intermixtures) kilograms	48,467	52,972	Brazil 34,000; Austria 10,000.
Selenium, elemental do	2,381	--	
Silicon tons	20,829	52,992	Spain 10,553; Republic of South Africa 8,084; Portugal 7,568.
Silver:			
Ore and concentrate	4,000	4,109	Republic of Korea 2,130; Mexico 1,979.
Waste and sweepings value	$34,416	$171,103	All from Singapore.
Metal including alloys, all forms thousand troy ounces	17,923	17,209	Peru 6,402; Mexico 4,392.
Tellurium kilograms	3,000	8	Canada 5; United States 3.
Tin:			
Oxide	7	4	Australia 3.
Metal including alloys, all forms	28,378	28,769	Malaysia 15,952; Indonesia 6,566; Thailand 5,934.
Titanium:			
Ore and concentrate thousand tons	496	399	Malaysia 162; Australia 118.
Slag do	43	62	All from Canada.
Oxide	3,310	3,279	West Germany 1,492; United Kingdom 1,139.
Tungsten:			
Ore and concentrate	3,247	2,264	Republic of Korea 901; Canada 408; Peru 290; Australia 220.
Metal including alloys, all forms	97	109	Republic of Korea 85.
Uranium and thorium:			
Ores and concentrates	84	100	All from Zaire.
Oxides (composed of uranium and thorium depleted in U-235) kilograms	580	262	All from West Germany.
Metals including alloys, all forms do	565	--	
Vanadium pentoxide	2,052	2,656	Republic of South Africa 2,400.
Zinc:			
Ore and concentrate thousand tons	963	937	Canada 366; Peru 288; Australia 228.
Oxide	1,981	2,877	Taiwan 747; Singapore 717; Republic of Korea 681.
Metal including alloys, all forms thousand tons	29	34	North Korea 26.
Zirconium ore and concentrate (including zircon sand)	68,040	89,729	Australia 83,503.
Other:			
Ores and concentrates of base metals	10	40	Zaire 30.
Ash and residue containing nonferrous metals	28,716	45,144	Australia 13,315; Philippines 11,701; United States 11,458.
Oxides, hydroxides, pentoxides of metals	1,700	2,022	United States 561; Canada 285; U.S.S.R. 220.

See footnotes at end of table.

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Table 3.—Japan: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Other —Continued			
Metals including alloys, all forms:			
Metalloids[3]	10,666	17,700	Canada 9,640; United States 3,786; Italy 2,176.
Alkali and alkaline-earth metals	45	59	United States 37; U.S.S.R. 20.
Pyrophoric alloys (ferrocerium)	10	13	Austria 5; United States 3.
Base metals including alloys, all forms, n.e.s	1,059	2,613	Republic of South Africa 1,410; United States 607.
NONMETALS			
Abrasives, natural, n.e.s.:			
Crude	3,595	3,525	India 1,800; United States 1,163.
Dust and powder of precious and semiprecious stones kilograms	11,985	16,726	West Germany 16,000.
Grinding and polishing wheels and stones	242	196	United States 85; Italy 34; West Germany 32.
Asbestos thousand tons	301	235	Canada 111; Republic of South Africa 81.
Barite and witherite do	33	21	China, mainland, 17.
Boron materials:			
Crude natural borates do	49	57	Turkey 52.
Oxide and acid do	16	19	United States 17.
Cement do	1	2	United States 1.
Clays and clay products:			
Crude:			
Kaolin do	404	467	United States 365; Republic of Korea 72.
Kyanite, andalusite, sillimanite do	22	23	Republic of South Africa 16; India 5.
Other do	268	219	United States 96; China, mainland, 59; Republic of Korea 26.
Products:			
Refractory (including nonclay brick)	4,664	5,913	Sweden 2,337; United States 1,375; West Germany 1,027.
Nonrefractory	21,016	27,331	Italy 8,843; Republic of Korea 8,440; Taiwan 4,525.
Cryolite and chiolite	246	244	Denmark 132; Greenland 112.
Diamond:			
Gem, not set or strung thousand carats	749	808	India 249; Israel 237; Belgium-Luxembourg 132.
Industrial do	736	697	United States 171; Zaire 142; Republic of South Africa 111.
Powder and dust do	13,034	15,126	United States 8,378; Ireland 4,592.
Diatomite and other infusorial earth	5,046	5,871	United States 5,860.
Feldspar, leucite, nepheline, nepheline syenite	12,335	9,064	China, mainland, 5,750; Republic of Korea 1,656; India 1,111.
Fertilizer materials:			
Crude:			
Nitrogenous (natural sodium nitrate)	---	2,000	All from Chile.
Phosphatic thousand tons	2,652	2,599	United States 1,479; Morocco 515.
Manufactured:			
Nitrogenous do	20	26	Chile 18.
Phosphatic do	64	86	United States 41; Republic of Korea 35.
Potassic do	1,315	1,323	Canada 615; U.S.S.R. 215; United States 152.
Mixed do	172	176	United States 147.
Ammonia	6	4	All from United States.
Fluorspar thousand tons	373	371	China, mainland, 150; Thailand 107; Republic of South Africa 101.
Graphite, natural do	65	49	Republic of Korea 27; North Korea 12.
Gypsum and plasters do	30	15	Mainly from Morocco.
Magnesite and magnesia clinker do	52	71	North Korea 46; China, mainland, 21.
Mica, all forms do	9	9	India 4; Malaysia 1.
Pigments, mineral, including processed iron oxides	2,852	3,876	West Germany 1,344; China, mainland, 1,098; United States 806.
Precious and semiprecious stones, except diamond:			
Natural	652	712	Brazil 427; India 145.
Manufactured	25	22	West Germany 12; United States 6.
Pyrite, gross weight	34,060	30,000	All from Philippines.
Salt thousand tons	6,415	6,436	Australia 3,198; Mexico 3,101.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	47,440	43,249	Taiwan 35,463; United States 7,535.
Caustic potash and sodic and potassic peroxides	127	78	United States 68.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked thousand tons	410	465	India 111; Republic of Korea 95; Republic of South Africa 78.

See footnotes at end of table.

Table 3.—Japan: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Stone, sand and gravel —Continued			
Dimension stone —Continued			
Worked _ _ _ _ _ _ _ _ thousand tons_ _	45	65	Republic of Korea 39; Italy 7; Taiwan 7.
Dolomite, including agglomerated dolomite_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ do_ _ _ _	229	166	Republic of Korea 145.
Gravel and crushed rock _ _ _ _ _ _ _ do_ _ _ _	83	188	Taiwan 170.
Limestone _	595	1,301	France 1,032.
Quartz and quartzite _ _ thousand tons_ _	171	78	Republic of Korea 25; Thailand 18; China, mainland, 15.
Sand, excluding metal bearing_ _ _do_ _ _ _	485	559	Australia 424; Taiwan 83.
Sulfur:			
Elemental, colloidal _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	781	563	United States 557.
Sulfuric acid _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	5	(6)	NA.
Talc, steatite, soapstone, pyrophyllite thousand tons_ _	361	448	China, mainland, 247; Australia 90; Republic of Korea 58.
Other:			
Crude:			
Meerschaum, amber, jet _ kilograms_ _	2,127	81,089	United States 53,069; Spain 27,590.
Unspecified _ _ _ _ _ thousand tons_ _	313	280	Republic of Korea 167; Philippines 39; Australia 26.
Slag, dross, and similar waste, including kelp, not metal bearing_ _ _ _ _ _ _ do_ _ _ _	146	205	India 106; Republic of Korea 77.
Oxides, hydroxides, and peroxides of magnesium, strontium, barium _ _ _ _ _ _ _ _ _	308	444	United States 248; West Germany 154.
Bromine and iodine _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	708	1,079	Israel 1,015.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural _ _ _ _ _ _ _ _ _ _ _ _	8,580	4,074	United States 3,545; Trinidad and Tobago 529.
Carbon black _ _ _ _ _ _ _ _ _ _ thousand tons_ _	7	8	United States 4; U.S.S.R. 2.
Coal, including briquets:			
Anthracite _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ do_ _ _ _	1,489	1,052	Vietnam 437; China, mainland, 329.
Bituminous:			
Heavy coking coal:			
Less than 8% ash _ _ _ _ _ do_ _ _ _	17,814	13,067	United States 5,613; Australia 3,796; Canada 1,156.
More than 8% ash_ _ _ _ _ do_ _ _ _	27,236	25,856	Australia 13,405; Canada 9,689.
Other coking coal _ _ _ _ _ _ _ _ _ do_ _ _ _	14,301	12,201	Republic of South Africa 7,977; United States 1,613; Australia 1,556.
Lignite and lignite briquets _ _ _ _ do_ _ _ _	43	36	All from Australia.
Coke and semicoke_ _ _ _ _ _ _ _ _ _ _ _ _ _ do_ _ _ _	204	62	Argentina 27; United States 21; Australia 12.
Gas, hydrocarbon (liquefied natural gas) thousand 42-gallon barrels_ _	84,211	129,602	Brunei 61,071; Indonesia 43,152.
Hydrogen, helium, rare gases _ _ kilograms_ _	123,734	163,610	United States 162,885.
Peat, including peat briquets and litter _ _ _ _	6,198	7,016	Canada 5,318; U.S.S.R. 1,326.
Petroleum:			
Crude _ _ _ thousand 42-gallon barrels_ _	1,666,878	1,646,045	Saudi Arabia 519,526; Iran 294,408; Indonesia 216,639.
Refinery products:			
Gasoline and petroleum spirits[7] _ _ _ _ _ _ _ _ _ _ _ _ _ _ do_ _ _ _	52,242	64,611	Singapore 26,177; Kuwait 12,943; Saudi Arabia 9,796.
Kerosine and jet fuel _ _ _ _ _ _ _ do_ _ _ _	2,861	2,441	Singapore 2,239.
Distillate fuel oil _ _ _ _ _ _ _ _ _ do_ _ _ _	95,231	68,766	Saudi Arabia 40,668; Kuwait 12,284.
Residual fuel oil_ _ _ _ _ _ _ _ _ _ do_ _ _ _	75,587	63,736	Indonesia 22,631; Kuwait 12,871.
Lubricants _ _ _ _ _ _ _ _ _ _ _ _ _ do_ _ _ _	877	730	United States 415.
Other:			
Liquefied petroleum gas _ do_ _ _ _	125	1,915	Australia 1,104; Saudi Arabia 425; Kuwait 286.
Paraffin _ _ _ _ _ _ _ _ _ _ _ _ do_ _ _ _	27	55	Singapore 27; United States 22.
Petroleum coke _ _ _ _ _ _ _ do_ _ _ _	10,171	10,053	United States 8,145.
Unspecified_ _ _ _ _ _ _ _ _ _ do_ _ _ _	65	228	United States 85.
Total _ _ _ _ _ _ _ _ _ _ _ _ do_ _ _ _	237,186	212,585	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand tons_ _	137	127	Republic of Korea 62; Taiwan 33; United States 14.

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[r] Revised.

[1] Excludes imports under the Japanese-United States Mutual Defense Agreement and those for the account of the U.S. military forces.

[2] Includes zinc sulfate.

[3] Includes ferruginous manganese and manganese dioxide.

[4] Includes cerium fluoride and lanthanum nitrate.

[5] Includes phosphorus, lithium, boron, and arsenic.

[6] Less than 1/2 unit.

[7] Includes naphtha.

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COMMODITY REVIEW

METALS

Aluminum.—Japan is the second largest aluminum producing and consuming nation in the world after the United States. Its capacity to produce metal totals 1.64 million tons per year, and its primary ingot consumption amounts to 1.8 million tons annually. However, Japan's industry is at a competitive disadvantage inasmuch as it must import all of its bauxite-alumina needs (mostly from Australia, Indonesia, and Malaysia). Furthermore, alumina reduction is highly energy intensive, and Japanese electricity rates have risen sharply owing to higher oil prices and to a higher percentage of oil-fired thermal power generation in Japan. Thus, increasing amounts of foreign aluminum metal—less costly than Japanese metal—have been imported.

Nippon Light Metal Co., Sumitomo Aluminum Smelting Co., Mitsubishi Light Metal Industries, Ltd., Showa Keikinzoku K.K., and Mitsui Aluminium Co. have collectively incurred an accumulated loss since the oil crisis of nearly Y100 billion at the end of FY 1980. These companies formed an antidepression cartel in September 1978 to reduce output and to increase ingot prices. The industry resolved to freeze 530,000 tons of annual capacity until June 1983, thereby also lowering excess inventory. Ingot prices were raised incrementally in four stages in 1979, and the fifth hike scheduled for January 1980 was to bring ingot price 51% higher than the price level at the end of 1978.

To improve their weakened domestic position, Japanese aluminum producers were involved with overseas ventures. The Asahan project in North Sumatra, a Japanese-Indonesian venture, was estimated to cost initially Y250 billion. The Amazon project, a joint Brazilian-Japanese venture, was established in October 1978. Both projects, owing to their high cost and the depressed financial status of the domestic industry, are Japanese-Government-supported national ventures.

Venezuela de Aluminio CA, a Venezuelan-Japanese project, started operations in June 1978. The first shipment of metal from this venture—7,000 tons of ingot—arrived in Japan in January 1979. Japanese producers are also tied in with New Zealand Aluminum Smelters, Ltd.

Copper, Lead, and Zinc.—Japan's lead and zinc industry is intertwined, and producers of lead and zinc are producers of copper as well.[7] The major mining and smelting companies include Dowa Mining Co., Ltd., Furukawa Mining Co., Ltd. (copper only), Mitsubishi Metal Corp., Mitsui Mining & Smelting Co., Ltd., Nippon Mining Co., Ltd., Nisso Smelting Co., Ltd. (lead and zinc only), Nittetsu Mining Co., Ltd. (copper only), Sumitomo Metal Mining Co., Ltd., and Toho Zinc Co., Ltd. (lead and zinc only).

The industry recovered in 1979 as a result of increased demand, the decline in yen value, and higher international quotations for metals. Mines were reopened which had been shut down in 1978. The rise in smelting costs is a major concern for Japanese metal producers, particularly in the case of lead, where the electrical consumption rate is high.

Japan consumes significant amounts of copper, about 1.2 million tons per year, for the manufacture of wire and cable, and brass. Production of refined copper is currently around 0.96 million tons. In 1978, when smelters purchased foreign ore at advantageous prices, the use of domestic ores sharply decreased to 6% of the total refined copper output during the year.

Lead consumption was about 270,000 tons per year, principally for storage batteries and inorganic chemicals. Output of refined lead runs about 230,000 tons annually. Mine output of lead ores has remained at a level of 60,000 tons during the past decade; however, imported ores increased at an average annual rate of 4.5% during the period to about 127,000 tons in 1978-79.

Zinc consumption is about 715,000 tons annually compared with production of 770,000 tons of slab zinc. In Japan, zinc is used mainly in galvanized sheet and other plating (tube and wire), in brass, and in diecasting. The share of domestic ores used in zinc metal production has increased slightly, from 230,000 tons to 260,000 tons, in this decade, while use of imported ore increased from 330,000 tons to 425,000 tons.

Japanese industry is involved with the development of the Musashi copper mine in Zaire and the Mamut copper mine in Malaysia. Both mines are problematic as to profitability, and in 1978 both were given a 3-year moratorium for their loans from the

Export-Import Bank of Japan and the Industrial Bank of Japan. Also, Japanese nonferrous metal producers were increasingly interested in participating in ore mine development projects in China.

Iron and Steel.—Japan's iron and steel industry is one of the largest in the world and has some of the world's most modern and efficient facilities.[4] There were 69 blast furnaces in operation in 1979. Large-volume blast furnaces, above 2,000 cubic meters each, numbered 39, of which 14 were larger than 4,000 cubic meteres in size. The largest blast furnace in Japan has an inner volume of 5,070 cubic meters. As for steelmaking, the number of basic oxygen furnaces totaled 94. Continuous casters totaled 131, producing upward of 40 million tons of semimanufactures each year. Efforts were made to increase the continuous casting ratio, and by the beginning of 1979, 46.2% of crude steel semimanufactures were made by this process.

Production of crude steel was over 110 million tons in 1979. By production type, basic oxygen furnaces accounted for about 77% of the annual output and electric furnaces for 23%. Continuous casting of semifinished steels for rolling was 85.75 million tons in 1978 and special steels for rolling, 14.5 million tons. Production by continuous caster expanded significantly from 41.6% of total semifinished steel output in 1977 to 46.2% in 1978.

Iron ore consumption in Japan ranges between 115 and 125 million tons annually. Domestic ore, including iron sands, pyrite sinter, and pellets, accounts for about 1.5% of total consumption. Japan's dependency on imports of ore, over 98%, is met from receipts primarily from Australia, Brazil, and India. The share of lump ores (sinter and pellets) rose from 2% in 1977 to 87.3% in 1978, a notable change in raw materials supply.

Annual coking coal consumption averages between 55 and 60 million tons. Apparent consumption of coal per ton of pig iron produced was lowered to 710 kilograms in 1978 from 732 kilograms in the previous year. Imported coking coal represents about 88% of total consumption. The top suppliers to Japan are Australia, Canada, the Republic of South Africa, and the United States.

Other raw materials consumed by the industry included substantial quantities of pig iron and scrap. Imports of pig iron in 1978 were about 650,000 tons, mainly from Canada, Romania, and Australia, in that order; and for scrap, 3.23 million tons, from the United States, Australia, and the U.S.S.R. Limestone and quicklime are locally available, while fluorspar consumption, around 200,000 tons annually, is imported from Thailand, China, and South Africa; and tin consumption, around 30,000 tons, is imported from Southeast Asia.

The major steel firms reported combined sales of $22.04 billion during the first half of FY 1978 with profits reaching $464.9 million. The return to profitability was based on an expansion of public works investments in Japan, rising domestic shipments of rolled steel, and the improvement in the unit price of steel. Furthermore, attempts were made in export markets to offset the high value of the year by raising export prices in dollar terms.

Equipment investment by the industry during FY 1978 totaled $2.83 billion on a construction basis, 13.2% lower than the previous year. Active investments were discouraged by existing surplus capacity over demand, the result of protracted weakness in the domestic and international steel market. Outlays for new facilities such as blast furnaces were much curtailed. However, plant maintenance and repairs were a main factor in the year's capital spending.

Equipment investment for pollution control totaled $302.4 million in 1978, down 22.1% from the prior year, reflecting the approaching completion of the industry's pollution control programs. The Government amended the air quality standard in July 1978, easing somewhat the emission standard for nitrogen oxides. The industry initiated joint activities to deal with NO$_x$ research and development programs and to grant subsidies for related work by other institutions. The law covering water quality standards was revised in June 1978, the changes extending pollution controls to the total quantity of pollutants released. The industry responded by raising the water recycle rate to reduce the pollution load in waste waters, and by installing various waste-water treatment facilities. Also, maximum reuse of waste materials such as slag and dust was being studied in the industry's research programs.

In July 1979, Nipon Kohan completed the move of its Keihin steel works with an annual crude steel output of 6 million tons to Ohgishima, a manmade island in Tokyo Bay. The move to Ohgishima was made at a total cost of Y1,000 billion, and marks what observers believe to be the end of the fierce

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competition to build gigantic steel complexes, which had lasted for about 30 years among Japanese steelmakers.

Nickel.—For lack of indigenous resources, Japan imports all of its nickel needs. During the decade, nickel consumption grew at an annual rate of 4.3%. Consumption was highest in 1974, peaking at 113,000 tons, declining precipitously to 74,000 tons in 1975, rebounding to 108,000 tons in 1976, and remaining at a level of 90,000 tons in 1977-79.

About 80% of the demand is for special steels (especially stainless steel). Nickel consumption for special steels increased from 48,000 tons in 1968 to the current level of consumption, 69,000 tons annually. Plating and nonferrous alloying are other nickel uses, constituting about 10% and 4%, respectively, of the total demand.

New Caledonia is the largest supplier of nickel ores and mattes to Japan, followed by Indonesia. Since 1969 Japan has ranked second after Canada in the free world in terms of nickel metal production. Metal producers were Japan Metallurgical Industries, Nippon Mining Co., Pacific Metals Co., Ltd., Shimura Kako Co., Ltd., and Sumitomo Metal Mining Co.

Other Metals.—Aside from copper, lead, and zinc, metal mine output is generally small in Japan. For instance, manganese output from fewer than 20 mines totals only about 30,000 tons of contained manganese, insignificant in terms of volume imports from Australia, Mexico, and South Africa. Consumption of manganese dioxide is close to 30,000 tons annually, compared with close to 1 million tons of combined ferromanganese and silicomanganese used in the iron and steel industry.

Mine production of molybdenum is about 200 tons; that of tungsten concentrates is about 1,200 tons, as is that of antimony. Mine output of other metal values includes gold, silver, and platinum-group elements.

Japan, however, is a significant producer of byproduct metals including cadmium, indium, and selenium. Other values recovered include arsenic, bismuth, and gallium.

Japan harvests large quantities of magnesium from seawater operations. Most of the production is for the manufacture of basic refractories containing magnesium oxide; a very small part (about 10,000 tons) is used in the production of magnesium metal. Japan imports around 400,000 tons of ilmenite and rutile annually from Australia, Canada, India, Malaysia, and Sri Lanka. It is a significant producer of titanium dioxide pigment and a small producer of metal.

Japan also produces other metals of high purity, generally in quantities prominent by world standards. Production of refined metals and compounds, mostly from imported materials, includes chromium, germanium, rare earths, silicon, tantalum, and uranium.

NONMETALS

Cement.—Japan ranks with the United States and the U.S.S.R. as the foremost producers of cement in the world.[9] Total industry capacity to produce cement was around 110 million tons per year. Japan's cement industry dates back more than 100 years and is as old as its iron and steel industry. The industry grew rapidly with overall Japanese economic growth. Production surpassed 40 million tons in 1967, reached 78 million tons in 1973, and surpassed 85 million tons in 1979.

In November 1975, producer-members of the Cement Association of Japan formed the first antirecession cartel to reduce production levels to meet slumps in demand and to cope with low prices. Because of the oil crisis and ensuing recession, production was cut sharply during 1974-76. In 1977, demand began to recover as a result of public investments and new construction activities.

The industry is comprised of 24 companies with 60 plants and 490 distribution terminals employing around 11,800 persons. Eight plants each produce less than 0.5 million tons per year, 9 between 0.5 and 1.0, 9 between 1 and 1.5, 13 between 1.5 and 2.0, 7 between 2 and 2.5, and 4 between 2.5 and 3.0; 10 plants produce over 3 million tons annually. The average annual production capacity per plant in 1979 was 1,835,000 tons.

Onoda Cement Co. and Nihon Cement Co. are the old mainline producers, collectively sharing 16% to 18% of the market. These producers are followed by other nationwide operators, Mitsubishi Mining & Cement Co., Sumitomo Cement Co., and Ube Industries, Ltd.; and by regional producers, Chichibu Cement Co. (Tokyo and vicinity) and Osaka Cement Co. (Osaka and environs).

About 59% of the domestic sales are shipments of ready-mixed concrete, of which 95% is consumed for civil engineering projects and building construction. About 14% of total domestic sales is of concrete products. Exports account for close to 10% of the market, and miscellaneous uses for the remainder. By destination, Southeast Asia accounts for about 41% of total exports; West Asia, 43%; Oceania, 3%; and other areas, the remainder.

Prior to the stress placed on energy savings, producers were estimated to have consumed 90 liters of fuel oil "C" per ton of cement produced. In order to cope with soaring oil prices, manufacturers were attempting to switch to coal for firing kilns and also to switch to oil-fired dry kilns (rather than inefficient wet kilns) such as the new suspension preheaters (NSP).

Onoda Cement, Mitsubishi Mining & Cement, Chichibu Cement, and Nihon Cement have independently developed NSP technology. Compared with conventional kilns, energy cost savings of NSP were estimated to be around 20% in addition to doubling production efficiency. Japan's Environment Agency regulates nitrogen oxide (NO_x) emissions at 480 parts per million (ppm) for existing kilns and at 550 ppm for newly installed kilns. NO_x emissions by NSP-equipped kilns were less than 250 ppm. Within 2 to 3 years, it was expected that about 40% of Japan's total cement output would be by coal-fired facilities.

Fertilizer Materials.—Japan's chemical fertilizer industry is one of the largest in the world. However, the industry has been adversely affected by low plant operation rates due to international competitiveness, narrowing export markets, and increased costs. In 1979, the fertilizer producers collectively decided to reduce capacity by 1,158,400 metric tons per year for ammonia (29.7% of total capacity) and by 1,720,000 tons for urea (43.3%). Manufacturers who reduce capacity would share in a Y1.5 billion aid pool, provided under a formula developed by the Japan Urea and Ammonium Sulfate Industry Association. In addition, producers were to diversify into manufacture of nonfertilizer products as well as new fertilizer compounds and formulas. In FY 1980, permanent suspension of operations of large ammonia and urea units was expected in facilities of Nihon Ammonia Co. (a joint venture of Sumitomo, Showa Denko, and others) and by the Mitsubishi group. Previously Showa Denko, Sumitomo, Ube Industries, Inc., and Kyowa Hakko Kogyo Co. had retired surplus capacity. In April 1979, Kashima Ammonia Co. and Nippon Kasei Chemical Co., both part of the Mitsubishi group, were merged; plans were being made to freeze its ammonia and urea output until June 1983.

Although urea exports were expected to decline, total industry capacity reduction was based on annual export shipments of 1 million tons per year. While China completed construction of 11 of 13 pairs of large ammonia and urea plants in late 1979, Japan continued to export about 1 million tons of nitrogenous fertilizers to China.

Japan's fertilizer export association was attempting to diversify its distribution to new foreign destinations in face of competition from foreign producing countries. In addition, the Japanese Government continued to purchase a small volume of domestically produced urea and ammonium sulfate, given as aid to developing countries—Bolivia, India, Nepal, Pakistan, the Philippines, Sri Lanka, and Sudan.

Mitsubishi Chemical Industries and Zenno (National Federation of Agricultural Cooperative Association) agreed to participate with Estech General Chemicals (formerly Swift Chemicals of the United States) in the development of a phosphate rock project whereby 350,000 to 400,000 tons of phosphate would be shipped annually to Japan beginning in 1983. In another venture, Mitsubishi Corp. contracted with Arab Potash Co. to obtain 600,000 tons of potassium chloride a year for 1985-86 for sales throughout Asia and Oceania.

Salt.—Japan's output of salt, all from evaporites, averages about 1 million tons per year. Most of the industrial demand is met by imports primarily from Australia and Mexico. Imports of salt during 1977-79 have averaged about 6.5 million tons per year.

Aside from human consumption, salt is used mainly by the chlor-alkali industry in the production of caustic soda. Domestic production of caustic soda is around 3 million tons annually; significant quantities are exported, principally to Australia and South Korea. One of the main uses for caustic soda is in the Bayer process for alumina production.

Because of the mercury pollution in the 1960's, the Government decreed that the caustic soda industry eliminate the use of mercury cells by December 1984. By 1978, mercury cell capacity was 1.8 million tons out of total soda capacity of 4.5 million tons annually. Commercial development of iron exchange membranes for chlor-alkali production in Japan was led by Asahi Glass Co. and Asahi Chemical Industry Co. The latter company signed licensing agreements with Prince Albert Pulp Co. and St. Anne

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Nackawic Pulp and Paper Co., both of Canada, and with Akzo Zont Chemie Nederland B.V. Additionally, Asahi Chemical signed agreements with four electrode manufacturers in the United States and Europe for the production of electrodes for the licensees of Asahi Chemicals process. Asahi Glass was involved with similar agreements with Pittsburgh Plate Glass and Olin Corp., with Britain's Imperial Chemical Industries, Inc., and with Uhde GmbH, Hoechst A.G., and Bayer A.G. of the Federal Republic of Germany.

Other Nonmetals.—In addition to aggregates, Japan produces significant quantities of pyrite, byproduct sulfur, and pyrophyllite. Its chemical industry produces large quantities of halogens, lime, and sodium compounds. Sufficient quantities of gypsum are recovered for use by the cement manufacturers. Minor quantities of asbestos, barite, feldspar, and fluorspar are produced domestically.

MINERAL FUELS

Coal.—The Government's national policy on domestic coal mining sets output at 20 million tons per year. However, coal production remained at the 18.5-million-ton level during the 1970's. To meet demand, Japan imports between 50 and 60 million tons of coal per year, with substantial receipts from Australia and the United States.

Domestic producers pushed for price hikes inasmuch as operating, transport, and personnel costs increased by Y730 per ton. However, the two principal users, electric utilities and the iron and steel industry, refused to accept increased prices equivalent to the increased operating costs. It was estimated that domestically produced coal was Y8,000 per ton higher than imported coal.

To compound the problem, the steel industry decreased receipts of domestic coal in 1979 from 7.3 million tons to 6.3 million tons, citing the worldwide slump in the steel market. Also, the steel producers feared that their competitiveness on the international market may drop if they use domestic coal whose prices were twice as high as imported coal.

Because the coal producers were at a disadvantage owing to pricing, stockpiles of coal began to swell as users preferred imported coal. Coal industry stocks were over 3 million tons by October 1978, and 3.7 million tons by March 1979, and were expected to reach 5 million tons by March 1980. The costs to stockpile the coal at company stockyards were estimated to be Y30 billion at the end of October 1978.

Japan's coal mining companies included Hokkaido Colliery & Steamship Co., Matsushim Kosan Co., Mitsubishi Coal Mining Co., Mitsui Coal Mining Co., Sumitomo Coal Mining Co., and Taiheiyo Coal Mining Co. While some companies incur a deficit up to Y1,200 per ton, the average industry loss was estimated at Y795. Hokkaido Colliery, suffering a cumulative deficit of Y120,000 million, began to revitalize its management plan in 1978. Its Yubari mine produced only 3,500 tons a day in 1979 compared to a target of 4,300 tons. Some seams were not suited for mining operations, and locations of others resulted in increased per-ton production costs. The gas explosion at its Horanai mine in 1975 where drilling operations reached 500 meters underground increased the industry's uneasiness over the danger in maintaining deep-seam mines. By March 1979, debtors such as Mitsui Bank, Ltd., and Misui & Co. stopped financing Hokkaido Colliery.

To aid the coal producers, the Government earmarked Y250 per ton as a subsidy to steel companies for each ton of domestic coal consumed. However, the steel companies felt that the subsidy was too small, and that they may be asked to increase intake of domestic coal.

Domestic coal producers tried investments in overseas operations, particularly in Australia, to alleviate financial difficulties at home. Australian foreign restriction law allows up to a 49% investment. However, Japanese developers' equities were only 15%, with the exception of Taiheiyo Coal, which was financially able to make a capital participation to the extent of 49%. Foreign coal development projects are costly for financially ailing Japanese companies, requiring large equity. The cost for obtaining a mining and exploration lease for a deposit having an annual production potential of 2 million tons was Y2,000 million. Furthermore, Y20,000 million is usually required to launch development activities. The Government was to provide financial assistance, on the other hand, for developing two Chinese coal mines, capable of producing 4 million tons per year.

Natural Gas.—Japan produces little natural gas and hence is involved with foreign countries in liquefied natural gas and petroleum gas (LNG and LPG) projects. Mitsubishi is involved with LNG in Brunei, Mitsui with LNG in Abu Dhabi, and Nissho-

Iwai Co. with LNG in Indonesia. Mitsui and Mitsubishi are jointly tied in with an LNG project in Australia. As to LPG production projects, C. Itoh was to start importing gas from Dubai in 1980, and Mitsui's status in Iran was undecided.

Petroleum.—Japan's domestic production of crude oil is insignificant compared with annual imports of around 280 million kiloliters. Because of its dependence on foreign oil, the industry faced increased cost for oil and the need to secure dependable supply. Oil-producing countries contended that higher prices were necessary to preserve oil resources. Following the political chaos in Iran, producing nations also initiated direct sales with users and Government-to-Government sales, bypassing major firms. By 1979, Japan's oil supply commitments were dwindling as a result of majors not renewing supply contracts following expiration to nonaffiliates. In the spring of 1979, Exxon Corp. notified nonaffiliates of its decision: extension by 6 months of supply contracts with the volume to be cut by one half, and termination of supply after the 6-month period. Exxon's subsidiary, Esso Eastern Inc., acquired 49% equity in General Sekiyu also in the spring of 1979. Exxon's notification of suspension of oil supply was followed by similar decisions by British Petroleum Co., Royal Dutch Shell, Caltex Petroleum Co., and Gulf Oil Corp.

To insure supplies, Japan's share of direct purchases and Government-to-Government purchases increased gradually. These purchases accounted for 23.4% of total imports at the end of the first quarter of 1979; increased to 31.8% in the second quarter and to 32.8% in the third quarter; and reached close to 40% at the end of the year. In addition, some refiners resorted to spot deals to procure supplies.

In June 1978, the Government revised the law whereby the Japan Petroleum Development Corporation became the Japan National Oil Corp. and allowed the new entity to stock oil. Under the provisions of the revised law, refiners and trading companies are to stock a 90-day supply of oil by the end of FY 1980, and the Government was to stock 20 million kiloliters (equivalent to a 20-day supply) by the end of FY 1982. Also the Japan National Oil Corp. signed a basic agreement with China in 1979 to explore for oil in the southern and western Bohai Gulf.

In 1979, construction of the petrochemical complex at Bandar Khomeini (Bandar Shahpur) in Iran by the Mitsui group was 85% completed before suspension due to political turmoil. The Japanese agreed to invest money through the Overseas Economic Cooperation Fund (OECF) to aid Mitsui's added construction costs resulting from the suspension. OECF was to assist other projects: A petrochemical complex planned by Sumitomo Chemical in Singapore; a methanol plant planned by Mitsubishi Gas Chemical and C. Itoh in Al Jubail, Saudi Arabia; and a second complex in Al Jubail planned by Mitsubishi concerns.

Uranium.—After the United States, Japan is the world's second largest nuclear energy producer with a total capacity rated at 54,550,000 kilowatts by 72 plants. Lacking indigenous resources, Japanese utilities have contracted for deliveries of 150,000 tons of uranium (yellow cake) by 1990 and 170,000 tons by 1995. The major sources are Rio Tinto Zinc Corp., Ltd., of London; Denison Mines, Ltd., of Canada; GOGEMA, Nufcor of South Africa; and Ranger of Australia.

Overseas Uranium Resources Development Co. (Japan) in collaboration with COGEMA and the Governments of Spain and Niger began uranium production in Akouta, Niger, in August 1978. In 1979, Overseas Uranium found an uranium deposit, estimated to contain 30,000 tons of contained uranium, in Afasto, Niger.

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The Mineral Industry of Kenya

By Janice L. W. Jolly[1]

Kenya's mineral industry, and economy in general, experienced a slower performance during 1978 and 1979. Among other problems, the Fluorspar Company of Kenya went into liquidation in 1979, and was taken over by the Government. Inadequate transportation was to have caused spot shortages of cement and salt through much of the period. Although the oil products line to Nairobi became operational in 1978, the cost of imported oil was forming more and more of the nation's import bill while exports were decreasing. Imports, which had been financed mainly by higher tea and coffee revenues during the "boom" conditions of 1977, increased in value by 33% during 1978 while export revenues dropped. A serious balance of payments position resulted and stringent import and credit controls were instituted in late 1978. A 25% import deposit was required for crude petroleum, but by yearend 1979, this requirement was dropped as the foreign exchange situation began to improve slightly. The value of exports declined 5% during the first 9 months of 1979, while imports fell by 16%, thus providing some reduction in the visible trade deficit from the record 1978 level. Inflation, which averaged 15% per year over the 1974-78 period had fallen to 8.1% in the 12 months to November 1979.

Kenya is basically an agricultural country with this sector accounting for over one-third of the nation's gross domestic product (GDP) estimated at $5.7 billion[2] for 1978 and $6.3 billion for 1979. A sharp drop in world prices for coffee and tea was the primary cause for the poor performance shown by the domestic economy and trade accounts. Although Kenya produces a wide variety of mineral products, it has thus far been of small significance to the nation's economy. The manufacturing sector, which in 1978 represented about 16% of the nation's GDP, registered a 14% increase in production and was the fastest growing sector of the economy. However, this was primarily the result of strong domestic demand, since exports of manufactured products, including many metal and petroleum products, were down.

Under the new government formed after President Kenyatta's death in 1978, foreign investors were to continue to enjoy the benefits of the Foreign Investment Protection Act. Foreign investment played a major part in the development of the industrial-sector, accounting for 15% in 1972 and 14% in 1976 of the gross investment. The fourth development plan (1979-83) estimated that about $860 million will be required for industrial-sector investment in the next 5 years. Foreign investment will be particularly encouraged in priority industries, including basic steel and heavy-chemical industries, that require advanced technology and skills. The Government does not intend to participate in financing the development of the majority of new industries; instead, it will identify new investment opportunities, find partners for foreign investors in the country, help local investors with feasibility studies, and provide infrastructure such as roads and services. The target is a 9% per year growth in manufacturing over the plan period.[3] New projects proposed, announced, or completed during 1978 included the expansion of a ceramics plant at a cost of $3 million and a steel-casting plant worth $8 million, both of which involved participation by parastatal organizations. Work on the $5 million extension to the steel-rolling mill at Kikuyu was nearing completion in 1979.

The rapid growth of Kenya's economy in

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the last decade had placed tremendous demands on the transport and electrical supply sectors. As a result of plans to expand or improve these services, Kenya has negotiated several loans from the international financial community. Road improvement loans were forthcoming from the World Bank ($90 million), U.S. Agency for International Development ($57 million), Norway ($3.1 million), Britain ($175,000) and Japan ($2 million). Railway improvements were to be financed through loans from West Germany ($7 million), Sweden ($4 million) and Britain. When completed, the Government-owned Kenya Railways will have 125 new diesel locomotives, 3,600 wagons, and 27 passenger coaches. The modernization program also includes improvement of the railway yards and construction of a containerization terminal at Mombasa. Loans were also secured for Kenya's two major electricity projects, the Tana River hydroelectric project, and the Olkaria geothermal project. Contributing to the Tana River hydroelectric station on the Upper Tana River were the West German Government ($41 million), the European Investment Bank ($16 million), the European Development Fund, the United Kingdom, and the Government of Kenya. Three major power stations were already in operation on the Tana River, and there were expected to be at least three more potential hydroelectric sites developed here over the next 15 years. The 1,000-kilometer-long Tana River is Kenya's largest River, and the only substantial source of hydroelectric power generation.

The Kenya Power Company project for exploiting geothermal electrical power at Olkaria was to cost about $66 million and was being financed by the World Bank (9 million), the Commonwealth Development Corporation, and partly by the Government-owned Kenya Power Company itself. It was estimated that geothermal electrical energy will be considerably cheaper than oil-fired systems, but slightly (about 10%) more than the recently commissioned hydro-power stations. Extensive investigations including geological, chemical, and geographical surveys have been made by the United Nations Development Programme (UNDP). The initial project will be capable of generating 15 megawatts of electric power, and will be followed by further drilling for a second 15-megawatt unit. By late 1979, three Japanese companies had received orders for $11 million worth of equipment to be used in the geothermal powerplant, which the West German firm of Brown-Boveri was to build for Kenya Power Company.

A recently concluded airborne exploration program was carried out by Terra Surveys of Ottawa, Canada, and was financed through a loan made available by the Canadian International Development Agency (CIDA). The exploration concentrated on two areas: Area I in southeastern Kenya and Area II in western Kenya. The final results of the survey were made available as open-file reports from the Commissioner of Mines and Geology, Mines and Geological Department in Nairobi, Kenya. Past mineral development in Area I has been confined to the gemstone belt, and a number of industrial minerals that included magnesite, kyanite, graphite and asbestos. In addition, serpentinized ultramafic rocks in the area were considered favorable hosts for chromite. Uranium was considered a potential in the eastern part of Area I where Permian-Triassic Karroo type sediments occur. Mining in the Karroo sediment area has been mostly from barite-lead and lead-silver vein deposits. Other deposits with potential include a large carbonatite complex that is currently under investigation, and a significant disseminated sphalerite deposit that was discovered within sandstone. Area II contains greenstone belts of Archean volcanics and sediments, and includes a sequence of rhyolitic volcanics rocks that are considered favorable hosts for massive sulfide deposits of the volcanogenic type. Past mining in Area II has been confined to gold and copper. The Kenya Mines and Geological Department was doing a followup program that included mapping, geochemistry, and geophysics. Some diamond drilling of priority anomalies was also underway. Three additional agreements relating to agriculture and mining were also signed in 1979 with Canada that would provide Kenya over $10 million for mining development.

PRODUCTION AND TRADE

Much of Kenya's mineral industry remained somewhat static throughout 1978 and 1979, although several commodities showed significant production increases in 1978, such as crude phosphatic fertilizer materials, soda ash, kaolin, and gold. Others showed a decrease including barite, feldspar, diatomite, and fluorite. Although domestic demand was high, cement production remained a problem. Mineral production in 1978, excluding petroleum products, was valued at $95.5 million.

The cost of imported oil more than doubled after the 1978 Iranian crisis, and was forming more and more of the nation's import bill, while the value received for petroleum product exports decreased. For the first three-quarters of 1979, petroleum products formed 19% of the total import value of $1,187 million, and 16% of the total export value of $908 million. In contrast, total exports for 1978 were valued at $1,070 million and total imports at $1,787 million. Crude petroleum products contributed 18% to the total export value for 1978. Kenya relied on Iran for 45% of its petroleum needs in 1978. The major suppliers were Iran, and Saudi Arabia, which accounted for over 60% of the country's crude petroleum requirements. Hard hit by higher oil prices, Kenya was maintaining a 6-month supply.

The Kenyan Government was considering the introduction of an export credit insurance and guarantees scheme to help exporters increase and diversify their trade. If adopted, the scheme would enable exporters to spread the large number of operational risks by serving as collateral when dealing with banks. Despite efforts to narrow the gap between Kenya and Japan, there was still a pronounced imbalance of trade. Exports to Japan in 1978 were valued at $9.5 million, compared with $175.7 million for imports. During the first 6-months of 1978, Japan imported 8,157 tons of fluorite from Kenya, but Japanese iron and steel makers were consuming much less fluorite than in the past owing to modified production methods. Kenya was to sell about $5 million in fluorite to the Soviet Union in 1980 after an agreement between Kenya Fluorspar Co. Ltd. and Soyuspromexport of Moscow. Another consignment of 12,000 tons was exported to West Germany in 1979. Kenya exported about 15,000 tons of soda ash to southeast Asia in late 1979. A similar cargo went to Singapore and neighboring ports in June 1979.

Table 1.—Kenya: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Beryl, gross weight	1	--	--	NA
Gold, mine output, metal content troy ounces	37	135	205	200
Iron and steel:				
Iron ore, gross weight	20,784	16,000	20,129	20,000
Crude steel	10,000	10,000	10,000	NA
Lead, mine output, metal content[e]	480	--	--	--
Silver, mine output, metal content troy ounces	118	--	--	--
NONMETALS				
Barite	359	429	298	NA
Cement, hydraulic	986,874	1,144,429	1,124,690	[1]940,000
Clays: Kaolin	2	495	1,514	NA
Corundum	[r]15	--	([2])	NA
Diatomite	2,668	2,441	1,696	NA
Feldspar	1,115	1,869	949	NA
Fluorspar	75,027	124,000	106,564	100,000
Gem stones, precious and semiprecious:				
Aquamarine kilograms	3	10	275	NA
Garnet[3] do	126	160	274	NA
Ruby do	810	532	316	NA
Sapphire do	([2])	4	1	NA
Tourmaline do	20	23	23	NA
Gypsum and anhydrite	78,020	25,999	[e]30,000	30,000
Lime and limestone	30,059	77,826	[e]50,000	27,000
Magnesite	3	3,575	[e]4,000	NA
Meerschaum	51	--	--	NA
Phosphatic materials: Guano	219	55	19,943	NA
Salt:				
Crude	49,906	39,932	19,514	20,000
Refined	14,250	12,300	[e]12,000	12,000
Sodium compounds:				
Soda, crushed, raw	3,628	2,293	114	NA
Soda ash	108,763	109,444	152,522	NA
Stone, sand and gravel:				
Calcareous:				
Calcite	NA	600	[e]600	NA
Coral (for cement manufacture)[e]	950,000	950,000	950,000	NA
Kunkur (for cement manufacture)	176,798	14,914	111,647	NA
Limestone (for cement manufacture)	193,157	50,197	[e]50,000	NA

See footnotes at end of table.

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Table 1.—Kenya: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Sand	16,994	17,665	23,758	NA
Shale	[e]200,000	[e]825,000	257,402	NA
Talc (pyrophyllite)	--	270	--	--
Vermiculite	3,587	4,220	1,863	2,000
Wollastonite	120	300	100	NA
MINERAL FUELS AND RELATED MATERIALS				
Carbon dioxide, natural	2,147	1,960	2,243	NA
Petroleum refinery products:				
Gasoline, motor thousand 42-gallon barrels	3,091	3,112	3,230	NA
Jet fuel do	3,046	3,013	3,023	NA
Kerosine do	338	--	--	NA
Distillate fuel oil do	3,654	4,126	4,103	NA
Residual fuel oil do	7,504	7,395	7,925	NA
Other:				
Asphalt do	--	207	[e]212	NA
Liquefied petroleum gas do	213	225	232	NA
Unspecified do	268	60	[e]70	NA
Refinery fuel and losses do	974	781	[e]809	NA
Total do	19,088	18,919	19,604	20,000

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] Reported figure.

[2] Less than 1/2 unit.

[3] Quality (gem or industrial) not specified.

Table 2.—Kenya: Exports and reexports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum metal including alloys:			
Scrap	361	445	Japan 289; Pakistan 156.
Unwrought and semimanufactures[2]	153	219	Uganda 147; Rwanda 47.
Copper metal including alloys:			
Scrap	510	504	India 418.
Unwrought and semimanufactures[3]	62	37	Somalia 9.
Iron and steel metal:			
Scrap	4,023	3,949	Belgium-Luxembourg 2,060; Uganda 1,790.
Semimanufactures:			
Bars, rods, angles, shapes, sections	3,318	4,357	Rwanda 1,561; Uganda 997; Burundi 572; Sudan 467.
Universals, plates, sheets[4]	1,541	3,693	Rwanda 1,432; Uganda 563; Sudan 515; Burundi 472.
Hoop and strip	30	15	Uganda 6; Burundi 4; Sudan 2; Rwanda 1.
Wire	273	909	Uganda 482; Burundi 293.
Tubes, pipes, fittings	2,028	1,175	Tanzania 304; Somalia 194; Rwanda 134; Sudan 128.
Castings and forgings, rough	12	--	
Lead metal including alloys:			
Scrap	663	360	India 285; Pakistan 48.
Unwrought and semimanufactures[5]	2	1	Mainly to Tanzania.
Magnesium metal including alloys, scrap	4	3	All to Netherlands.
Zinc metal including alloys:			
Scrap	308	416	Taiwan 172; India 149.
Unwrought and semimanufactures[6]	20	([7])	NA.
Other: Ash and residue containing nonferrous metals	237	58	India 19; Spain 19; Hong Kong 14; United Kingdom 6.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	587	259	Swaziland 180; United Kingdom 44.
Dust and powder of precious and semiprecious stones	25	--	
Grinding and polishing wheels and stones	5	10	Sudan 9.
Barite and witherite	31	32	Rwanda 20; Burundi 10.
Cement	662,192	610,132	Mauritius 154,729; Réunion 61,956.

See footnotes at end of table.

Table 2.—Kenya: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Chalk	340	274	Uganda 202; Burundi 61.
Clays and clay products (including all refractory brick):			
Crude	109	54	Uganda 51.
Products	873	669	Uganda 499; Tanzania 79.
Diatomite and other infusorial earth	879	457	Mauritius 198; India 58; Burundi 50; Swaziland 50.
Feldspar and fluorspar	100,208	102,900	United States 29,240; U.S.S.R. 22,418; Netherlands 16,085; Japan 12,753.
Fertilizer materials, manufactured:			
Nitrogenous	[8]167	177	Tanzania 100; Rwanda 40.
Other, including mixed	202	22	Sudan 13; Uganda 9.
Graphite, natural	2	--	
Gypsum and plasters	2,252	1,559	All to Uganda.
Lime	5,007	3,840	Ethiopia 1,260; Somalia 328.
Mica	--	20	All to Uganda.
Pigments, natural, crude	116	([7])	NA.
Precious and semiprecious stones, except diamond, natural grams	443,193	561,948	Hong Kong 249,355; India 69,581; United States 66,338; United Kingdom 58,743.
Salt and brines	817	85	Uganda 55; Sudan 14.
Sodium compounds:			
Caustic soda	1,502	541	Uganda 331; Rwanda 149.
Sodium carbonate (soda ash)	101,848	160,526	Thailand 22,610; Swaziland 15,770.
Stone, sand and gravel:			
Dimension stone, crude and partly worked	[9]13	8	Uganda 4; Tanzania 3; Zaire 1.
Dolomite	1	72	Mainly to Mauritius.
Gravel and crushed rock	1,563	1,804	Mainly to Uganda.
Limestone, except dimension	201	1,481	NA.
Sand, excluding metal bearing	44	422	Uganda 402.
Sulfuric acid, including oleum	34	19	Tanzania 10; Sudan 3; Uganda 1.
Talc and steatite, natural	([7])	6	Malawi 5; Uganda 1.
Other:			
Crude	2,989	825	Japan 670; Taiwan 84.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	57	21	Uganda 9; Somalia 7.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	1,594	1,213	Uganda 830; Rwanda 175.
Kerosine do	572	510	Uganda 445.
Jet fuel do	2,792	2,339	NA.
Distillate fuel oil do	1,629	1,365	Uganda 542.
Residual fuel oil do	3,731	3,557	Singapore 1,348; Italy 587.
Lubricants do	374	291	Zambia 84; Uganda 65; Somalia 29.
Other:			
Liquefied petroleum gas do	28	27	Uganda 21.
Nonlubricating oils, n.e.s do	7	8	Uganda 5; Zambia 3.
Bitumen and other residues and bituminous mixtures, n.e.s do	52	30	Uganda 12; Burundi 8; Rwanda 5.
Unspecified do	6	3	Mainly to Uganda.
Total do	10,785	9,343	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	195	188	Do.

NA Not available.

[1] Exports to Tanzania and Uganda, formerly treated as transfers, have been reclassified as regular exports.

[2] Excludes quantities valued at $1,306 in 1977 and $1,389 in 1978.

[3] Excludes quantities valued at $3,538 in 1977 and $2,769 in 1978.

[4] Excludes quantities valued at $875,113 in 1977 and $672 in 1978.

[5] Excludes quantities valued at $364 in 1977 and $457 in 1978.

[6] Excludes quantities valued at $594 in 1977 and $90 in 1978.

[7] Less than 1/2 unit.

[8] Excludes quantity valued at $119.

[9] Excludes quantity valued at $33.

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Table 3.—Kenya: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum metal including alloys:			
Unwrought	--	139	France 76; Switzerland 50.
Semimanufactures	3,554	3,841	Denmark 764; United Kingdom 713; Japan 493; Belgium-Luxembourg 409.
Copper metal including alloys:			
Scrap	31	([3])	All from Uganda.
Unwrought	60	25	Mainly from United Kingdom.
Semimanufactures	939	[3]1,003	United Kingdom 876; Zambia 369.
Gold:			
Metal troy ounces	288	260	Mainly from United Kingdom.
Waste and sweepings do	3,041	--	
Iron and steel:			
Ore and concentrate	7,644	35,602	Greece 24,503; India 11,000.
Metal:			
Scrap	NA	12	Mainly from Zambia.
Pig iron, ferroalloys, similar materials	1,064	1,121	United Kingdom 826; Norway 120.
Steel, primary forms[4]	23,038	32,157	Australia 15,970; Belgium-Luxembourg 9,063.
Semimanufactures:			
Bars, rods, angles, shapes, sections	26,751	26,369	Japan 7,150; United Kingdom 3,209; Federal Republic of Germany 2,803.
Universals, plates, sheets	[5]115,713	134,415	Japan 92,493; Italy 25,405.
Hoop and strip	2,269	2,637	Japan 1,156; United States 586.
Rails and accessories	2,384	17,739	United Kingdom 15,165; Federal Republic of Germany 2,560.
Wire	15,352	22,638	Romania 6,486; Poland 4,270; Belgium-Luxembourg 3,975.
Tubes, pipes, fittings	13,365	32,082	Federal Republic of Germany 20,621.
Lead metal including alloys:			
Unwrought	2,185	878	Zambia 393; United Kingdom 322.
Semimanufactures	125	55	Belgium-Luxembourg 27; Federal Republic of Germany 15; United Kingdom 11.
Magnesium metal including alloys, semimanufactures	6	NA	Mainly from United Kingdom.
Manganese ore and concentrate	1,672	1,595	All from Singapore.
Molybdenum metal including alloys, all forms value	$2,260	$2,931	Netherlands $2,170; Belgium-Luxembourg $760.
Nickel metal including alloys, unwrought and semimanufactures do	$115,621	$31,537	United States $17,561; United Kingdom $10,312.
Platinum-group metals including alloys, all forms, but not rolled troy ounces	406	6	United Kingdom 5; Federal Republic of Germany 1.
Silver metal including alloys, all forms do	20,176	6,173	Mainly from United Kingdom.
Tin metal including alloys:			
Scrap	100	--	
Unwrought	44	22	United Kingdom 17; Federal Republic of Germany 5.
Semimanufactures[6]	761	552	United States 340; Japan 149.
Zinc metal including alloys:			
Scrap and blue powder	21	51	Mainly from Belgium-Luxembourg.
Unwrought	4,279	8,000	Zambia 6,210.
Semimanufactures	841	[7]2,218	Belgium-Luxembourg 1,300; Japan 708.
Other:			
Ores and concentrates of base metals	1	20	Mainly from Federal Republic of Germany.
Metals including alloys:			
Pyrophoric alloys	1	([3])	Mainly from Austria.
Base metals[8]	18	14	United Kingdom 13; Uganda 1.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	72	7	India 2; Italy 2; Denmark 1; United Kingdom 1; United States 1.
Dust and powder of precious and semiprecious stones value	$321	$487	United Kingdom $266; Federal Republic of Germany $170.
Grinding and polishing wheels and stones	99	110	United Kingdom 35; India 29; China, mainland, 14.
Asbestos	1,572	797	Swaziland 400; Australia 240; Canada 155.
Barite and witherite value	--	$952	All from Federal Republic of Germany.

See footnotes at end of table.

Table 3.—Kenya: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Cement	845	373	United Kingdom 288; Federal Republic of Germany 85.
Chalk	11	108	United Kingdom 40; France 25; India 13; Federal Republic of Germany 10.
Clays and clay products (including all refractory brick):			
Crude	1,004	1,466	United States 1,046; United Kingdom 230.
Products:			
Refractory (including nonclay brick)	2,347	3,215	Federal Republic of Germany 1,491; United Kingdom 949.
Nonrefractory	2,334	3,881	United Kingdom 1,093; Italy 798; Romania 747.
Diamond, gem, not set or strung carats	5	7,645	All from India.
Diatomite and other infusorial earth	250	602	United States 561.
Fertilizer materials:			
Crude, phosphatic	6	20	All from Greece.
Manufactured:			
Nitrogenous	88,201	78,170	Belgium-Luxembourg 17,335; United Kingdom 15,776; Italy 12,500; Federal Republic of Germany 12,119; Spain 10,679.
Phosphatic	33,500	19,625	Federal Republic of Germany 8,024; United Kingdom 5,000; United States 3,113; Israel 3,078.
Potassic	7,338	10,752	Netherlands 5,500; Italy 2,750; Israel 1,500.
Other, including mixed	26,909	46,632	United States 22,700; Netherlands 7,000; United Kingdom 5,527; Romania 5,000.
Ammonia	183	206	Federal Republic of Germany 87; Japan 60; Netherlands 33; United Kingdom 24.
Graphite, natural	12	45	India 22; Japan 20.
Gypsum and plasters	23,281	182	United States 127; Federal Republic of Germany 40.
Lime	1	50	United Kingdom 45.
Magnesite	2	11	Netherlands 8; France 2.
Mica:			
Crude, including splittings and waste	25	34	United Kingdom 27; Netherlands 4.
Worked, including agglomerated splittings	(3)	1	Mainly from United Kingdom and United States.
Pigments, mineral, natural, crude	558	330	United Kingdom 182; India 133.
Precious and semiprecious stones, except diamond:			
Natural value	$6,442	$14,710	Federal Republic of Germany $5,514; India $3,194; United Kingdom $1,869.
Manufactured do	$10,907	$5,406	India $2,238; Federal Republic of Germany $1,250.
Salt and brines	19,364	35,354	Australia 25,368; Ethiopia 6,039.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	7,563	6,795	United Kingdom 3,688; Italy 1,600; Federal Republic of Germany 723.
Sodium carbonate (soda ash)	862	1,685	United Kingdom 716; Federal Republic of Germany 468; China, mainland, 200; France 200.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	100	80	All from Italy.
Worked	49	85	Mainly from Italy.
Dolomite, chiefly refractory grade	401	375	Italy 172; Federal Republic of Germany 161.
Gravel and crushed rock	30	21	United Kingdom 10; Netherlands 9.
Quartz and quartzite	7	11	Federal Republic of Germany 10; United Kingdom 1.
Sand, excluding metal bearing	332	398	Belgium-Luxembourg 275; Federal Republic of Germany 92.
Sulfur:			
Elemental	2,132	2,526	Federal Republic of Germany 920; United Kingdom 611; India 505; Poland 480.
Sulfuric acid, including oleum	997	1,013	United Kingdom 913.
Talc, steatite, soapstone, pyrophyllite	4,123	3,573	India 3,363.
Other, crude	1	(3)	All from Denmark.

See footnotes at end of table.

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Table 3.—Kenya: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	348	179	All from United Kingdom.
Coal and briquets:			
Anthracite and bituminous coal	62,010	47,738	Mainly from Mozambique.
Lignite and lignite briquets	(9)	23	All from United Kingdom.
Coke and semicoke	544	2,158	United Kingdom 1,785; Federal Republic of Germany 371.
Peat, including peat briquets and litter	(10)	25	Federal Republic of Germany 20; United Kingdom 5.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	17,934	17,116	Iran 7,781; Saudi Arabia 2,963.
Refinery products:			
Gasoline do	303	603	Bahrain 260; Iran 132; Italy 97; Saudi Arabia 59.
Kerosine and jet fuel do	782	1,315	Bahrain 623; Iran 204; Greece 142; Saudi Arabia 135.
Distillate fuel oil do	11	135	Italy 80; Bahrain 41; Kuwait 12.
Residual fuel oil do	--	70	All from Iran.
Lubricants do	521	460	Australia 236; United States 50; France 46.
Other:			
Nonlubricating oils, n.e.s. do	11	13	Federal Republic of Germany 3; United States 3; China, mainland, 2; France 2; Netherlands 2.
Mineral jelly and wax do	23	18	Federal Republic of Germany 5; Netherlands 4; Indonesia 3; United States 2; Japan 1.
Unspecified do	5	2	NA.
Total do	1,656	2,616	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,603	1,008	United Kingdom 900.

NA Not available.

[1] Imports from Tanzania and Uganda, formerly treated as transfers, have been reclassified as regular imports.

[2] Less than 1/2 unit.

[3] Excludes quantity valued at $1,569.

[4] Excludes quantities valued at $604 in 1977 and $1,402 in 1978.

[5] Excludes quantity valued at $2,206,322.

[6] Excludes quantities valued at $1,162 in 1977 and $4,973 in 1978.

[7] Excludes quantity valued at $1,399.

[8] Excludes quantities valued at $3,449 in 1977 and $4,482 in 1978.

[9] Value only reported at $304.

[10] Value only reported at $581.

COMMODITY REVIEW

METALS

Columbium (Niobium).—Kenya approved the assignment of development rights to Rhone Polenc of France for exploitation of the rare-earth deposit at Mrima Hill, located 80 kilometers southwest of Mombasa. The ore will be treated in France.[4]

Copper and Gold.—A recent survey revealed that economic deposits of gold and copper still exist in the abandoned mines at Macalder in South Nyanza District of Western Kenya. Plans to renew exploitation apparently depend upon the completion of the Karchugogo Falls electric power station.[5]

Iron and Steel.—The United Nations was considering financial assistance for the construction of a mini-steelworks at Mombasa. The plant would produce 300,000 to 400,000 tons per year of various steel products, using imported coal and iron ore from Swaziland. Direct reduction of Swaziland ore with electric arc furnaces and a rolling mill were also under consideration.

The galvanized iron sheet manufacturing company, Mabati Ltd., of Nairobi, was undergoing expansion to enable it to increase capacity from 15,000 tons to 60,000 tons per year. The factory will also manufacture pipes of up to 8 inches in diameter. Roofing-iron sheets produced at the plant were

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exported to Uganda, Zaire, the Sudan, Rwanda and Burundi.

NONMETALS

Barite.—A new barite mining company, Ewaso Mining Enterprises, entered the market with a product containing 91.4% barium sulfate. Supplied in bags, the ore was crushed into 1/2 inch pebbles. The firm was owned by John Seago and Charles Kerti Ole Sambo of Nairobi, Kenya.

Cement.—Inadequate rail transportation created cement shortages that lasted through most of 1978 and 1979, threatening development projects and the livelihood of many contractors. The situation was partly relieved in late 1978 when additional rail cars were allocated by Kenya Railways to transport cement to outlying areas. With the increase in demand, both cement plants were undertaking expansions, and a third plant was being planned. The Bamburi Portland Cement plant near Mombasa recently raised its production capacity to 1,250,000 tons per year, but the additional capacity was expected to be totally absorbed by 1983. The East African Cement Company plant at Athi River was increasing from 265,000 tons to 450,000 tons per year. The extensions will involve a total investment of more than $4 million, which will be financed by loans from the Danish and Belgian Governments, the European Investment Bank and the Kenya Commercial Bank. The Blue Circle Group was serving as consultant for the improvements. Kenya's current total cement production capacity was estimated at 1.5 million tons per year. Both cement plants operated under a common marketing company, Kenya Cement Marketing Ltd., to deal with cement distribution throughout the country. The price of cement was $76.90 per ton, and $4.10 per 50-kilogram bag in 1979.

Fertilizer Materials.—A large fertilizer plant was to be built in Mombasa as a joint project between the Government and the East African Oil Refinery. Negotiations were underway. The United Nations Food and Agricultural Organization's (FAO) commission on fertilizers recently approved a plan to make fertilizers available to developing countries at prices they can afford. The FAO estimates that 45 most seriously affected (MSA) nations will need to import 2.6 million tons of fertilizers, costing $800 million. The MSA countries, which includes Kenya, still cannot afford to purchase adequate quantities necessary to sustain and increase food production. The gap between fertilizer demand and ability to import has grown steadily. The FAO was calling for greater efforts to increase fertilizer production capacity in these countries. The Netherlands, Norway, and Japan will provide Kenya with 67,600 tons of fertilizer on a grant basis to help Kenya meet its requirements of 172,500 tons for the period 1979-80.[6]

Fluorite.—In August 1979, the Fluorspar Company of Kenya Ltd. was liquidated after being hit by recessions of the world steel industry, transportation problems, and phosphate contamination in some of the ore. The Kenyan Government took over all assets of the company including responsibility for the 1,200 workers, who will be absorbed into a new company to be called the Kenya Fluorspar Company.[7]

Gem Stones.—Large amounts of garnet and ruby were found by the Austrian mining company Austromineral at the end of December 1978 in the Taita-Tateva hills area. The area of gemstone deposits was reported to be 70 kilometers long. A deposit of iron ore (500,000 tons) and graphite (100 million tons) were described from the same area.[8]

Salt.—Kenya experienced a brief shortage of salt in late 1978 when more than 10,000 tons of refined salt was left lying in the Kensalt factory while a dispute carried on between the Kenya National Trading Corporation (KNTC) and the salt manufacturer. KNTC finally agreed to buy salt at the gazetted ex-factory price and to meet the transportation costs to their depots throughout the country. Salt Manufacturers (Kenya) Ltd., a new salt manufacturing company, was expecting to export surplus salt from the more than 100,000 tons of marine salt that the company was to produce near Malindi.

MINERAL FUELS

Petroleum.—The oil products pipeline serving Nairobi became operational in 1978. The 450 kilometer pipeline delivered a variety of fuels from the East African Oil Refineries, Ltd. (EAOR) petroleum refinery at Mombasa to Nairobi. Kenya Oil Pipeline Company (Ltd.) (KPCL) was operating four pumping stations at Changamwe, Maungu, Mtito Andei, and Sultan Hamud. With only two of the four pumping stations operating at Changamwe Mombasa and Mtito Andei, KPCL was able to deliver products to Nairobi at the rate of 240,000 liters per hour, which can be doubled when all four stations are engaged.

EAOR introduced a program to reduce

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the percentage of fuel used in operating the refinery in an effort to save foreign currency for petroleum imports. EAOR processed nearly 1.6 million tons of crude oil from January to August 1979, using 4.2% for refinery fuel. In 1978, 4.7% was used for refinery fuel. It was estimated that this represented a saving of $1.3 million in foreign exchange.

On October 26, 1979, the Kenyan Government and a group of three oil companies, consisting of Kenya Cities Service, Marathon Petroleum, and Union Oil Kenya, signed an agreement for oil exploration in an area north of Malindi in the Formosa Bay region. The group was given exclusive rights over 12,428 square kilometers both onshore and offshore. Elf-Somalia was withdrawing from Ras Binah and Kisimayo. The Simba No. 1 test hole was completed in March 1978 with no results. Simba No. 1 was drilled in 3,017 feet by drillship Pelerin for Total Petroleum Ltd. and Elf-Aquitaine.

Kenya began construction of a $60.4 million plant in Kisumu for production of alcohol from molasses. A second, smaller plant costing about $25 million was also planned in western Kenya. Annual output of the Kisumu plant was expected to be 7,390 tons of alcohol. A waste water treatment unit will eventually be part of the plant and will be capable of recovering methane, ammonium sulfate, and gypsum. The Government estimated that foreign exchange savings on oil substitution could reach $700,000 per year. The plant will be commissioned in October 1980.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Kenyan shillings (K Sh) to U.S. Dollars at the rate of K Sh7.40 = US$1.00 for 1978 and K Sh7.33 = US$1.00 for 1979.

[3] The Financial Times (London). Protection for Foreign Investors Continues. June 9, 1979, p. 27.

[4] Mining Journal (London). Rare Earths in Kenya. V. 293, No. 7507, July 6, 1979, p. 12.

[5] Standard Chartered Review (London). Kenya. September 1978, p. 12.

[6] Standard Chartered Review (London). Kenya. November 1979, p. 10.

[7] Standard Chartered Review (London). Kenya. January 1980, p. 14.

[8] Demain L'Afrique (Paris). Large Ore, Gem Deposits. Jan. 29, 1979, p. 61.

The Mineral Industry of North Korea

By E. Chin[1]

North Korea's second 7-year plan, in which mining was to be a priority sector, began in 1978. The targets for 1984, which called for doubling and even tripling output in some sectors, were revised in many cases to below the levels originally announced in 1974. While the major objectives in the mining industry remained unchanged, output of coal in 1984 was scaled down from 100 million tons to 70-80 million tons. The annual production targets for steel, nonferrous metals, and cement by 1984 were 8 million tons, 1 million tons, and 13 million tons, respectively.

At the third session of the Sixth Supreme People's Assembly held in late March 1979, the National Budget for 1978 was summarized and the National Budget for 1979 was approved. The 1978 budget was described as being "successfully settled with the enormous amount of 913.7 million won in reserve after spending a large sum of money to insure the accomplishment of the task of economic construction projected in the first year of the new prospective plan...elevating further the people's living standard." Additionally, the 1979 budget was characterized as "accurately organized to actively mobilize national revenue sources in order to insure the successful accomplishments of the People's economic plan of this year, intended for faster economic development..."[2]

Total revenue increased 13.5% to 15.7 billion won in 1978. Total revenue in 1979 was expected to reach 17.3 billion won. In terms of U.S. currency, one won is believed to be equivalent to about 105 cents. About 70% of the reported revenue was from trading and earnings from national and industrial enterprises, while the remainder was from local payments to the Central Budget and growth of savings from reduced material cost.

Total expenditures increased 10.4% to 14.7 billion won in 1978 and were planned to increase 17.3% in 1979. Expenditures in the mining industry increased 22% in 1978 over 1977 and were expected to be 1.4 times the 1978 outlay in 1979. Expenditures during 1979 in the chemical industry sector was to be 1.3 times the 1978 level; in the construction industry, 1.1; and in the machinery industry, 1.2.

Industrial growth in 1978 was reported as 117%, and investment for mining as 122% more than 1974. Substantial growth in other economic sectors was claimed for electric power, steel, construction, cement, and chemical fertilizers. In 1979, the Budget called for increasing further the 1978 accomplishments and reducing the cost of industrial production construction by 4.3% from the 1978 level. The construction target for the industrial sector in 1978 was reported as 2,914 projects. However, of the 12 major industrial facilities to be constructed in 1978, the only plant believed to be completed as planned was the Ponghwa chemical plant.

To date, there has been no commercial discovery of oil or gas in North Korea. To supplement indigenous coal mining and hydroelectric power generation, the country uses oil imported from China and the U.S.S.R.

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PRODUCTION

The Government of North Korea does not publish mineral production data for external dissemination. Production data, given in Table 1, denotes a relative order of magnitude of the country's output of fuels, minerals, and metals. Output by the minerals sector (all mineral industries are state-owned) was estimated to comprise about 20% of the country's gross national product.

North Korea produces a variety of mineral commodities.[3] Mineral output of coal, graphite, lead-zinc, magnesite, magnetite, and tungsten are significant by world standards. It is a medium-size producer of steel in the Orient. Apatite, barite, copper, gold, talc, and other metals and minerals also are produced. Petroleum and natural gas have not been discovered.

Table 1.—North Korea: Estimated production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[p]
METALS				
Aluminum, ingot, primary	10,000	10,000	10,000	10,000
Cadmium metal, smelter	[r]110	110	110	110
Copper:				
Mine output, metal content	15,000	15,000	15,000	15,000
Metal:				
Smelter, primary and secondary	20,000	20,000	20,000	20,000
Refined, primary and secondary	25,000	25,000	25,000	25,000
Gold, mine output, metal content troy ounces	160,000	160,000	160,000	160,000
Iron and steel:				
Iron ore and concentrate thousand tons	9,500	9,700	10,000	10,000
Metal:				
Pig iron[2] do.	3,000	3,500	4,000	4,000
Ferroalloys do.	70	90	110	110
Steel, crude do.	3,000	3,500	4,000	4,300
Semimanufactures do.	2,800	3,300	3,800	3,800
Lead:				
Mine output, metal content	110,000	110,000	105,000	105,000
Metal, primary and secondary	70,000	70,000	75,000	75,000
Silver, mine output, metal content thousand troy ounces	1,600	1,600	1,600	1,600
Tungsten, mine output, metal content	2,150	2,150	2,150	2,150
Zinc:				
Mine output, metal content	150,000	150,000	140,000	140,000
Metal, primary	135,000	135,000	130,000	130,000
NONMETALS				
Barite	120,000	120,000	110,000	110,000
Cement, hydraulic thousand tons	7,000	7,000	7,000	8,000
Fluorspar	30,000	40,000	40,000	40,000
Graphite	75,000	75,000	75,000	75,000
Magnesite:				
Crude thousand tons	1,500	1,500	1,500	1,500
Calcined do.	500	500	500	500
Nitrogen, N content of ammonia do.	270	410	450	450
Phosphate rock	450,000	500,000	500,000	500,000
Pyrite and pyrrhotite (including cuprous), gross weight	600,000	610,000	620,000	620,000
Salt, all types	540,000	550,000	560,000	560,000
Sulfur:				
From pyrite thousand tons	245	250	255	255
Byproduct of metallurgy do.	20	12	10	10
Total do.	265	262	265	265
Talc, soapstone, pyrophyllite	130,000	130,000	130,000	130,000
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Anthracite thousand tons	33,000	34,500	35,000	35,000
Bituminous and lignite do.	8,000	8,500	9,000	9,000
Total do.	41,000	43,000	44,000	44,000
Coke do.	2,500	3,000	3,500	3,500

[p] Preliminary. [r] Revised.

[1] In addition to the commodities listed, a number of other mineral commodities apparently are produced, but information is inadequate to make reliable estimates of output levels. These include (but are not limited to) antimony, arsenic (in arsenopyrite), asbestos, beryl, bismuth, boracite, kaolin (china clay), chromium, cobalt, columbite, germanium, indium, lithium minerals (lepidolite), manganese ore, mica (phlogopite), molybdenite, monazite, nickel and/or ferronickel, selenium, tellurium, titanium minerals (ilmenite and rutile), zircon, and a variety of crude construction materials including miscellaneous clays, glass sand, building sand, stone (crushed and dimension), and gravel.

[2] Includes granulated iron.

TRADE

All of North Korea's trade transactions are conducted by Government corporations. The state does not disseminate official data on foreign trade. Information on apparent mineral trade, given in Tables 2 and 3, are derived from countries which publish commerce data.

Exports of the leading mineral and metal commodities have included iron ore, pig iron, steel semimanufactures, lead and zinc, tungsten, cement, magnesite, and talc, compared with imports of chromium, manganese, coke, and mineral fuels. North Korea's main trading partners were China, Japan, and the U.S.S.R., not necessarily in that order. Other trade partners have included Australia, Canada, Israel, New Zealand, countries of Europe, and member nations of the Council of Mutual Economic Aid.

In 1978, North Korea's foreign debt was estimated to be $2 billion.[4] Payment of large purchases made earlier in the decade were lagging or in apparent default. Terms for repayment were renegotiated during 1978-79, notably with Japan. Other major creditors were China, the U.S.S.R., and several West European countries. Because of its lack of foreign reserves and ballooning trade debt, imports during 1978-79 were believed to be substantially lower than the level of imports in 1974, estimated to be $1.1 billion.

Table 2.—North Korea: Apparent exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977[1]	1978[2]	Principal destinations, 1978
METALS			
Copper metal including alloys:			
Scrap	105	3	All to Singapore.
Unwrought	275	25	All to Hong Kong.
Iron and steel metal:			
Scrap	3,484	--	
Pig iron	51,161	67,180	Japan 56,859; Hong Kong 10,321.
Ferroalloys	2,232	2,956	All to U.S.S.R.
Steel, primary forms	2,746	5,892	Thailand 2,722; Japan 1,801.
Semimanufactures:			
Bars, rods, angles, shapes, sections	NA	2,200	All to Sudan.
Plates and sheets	NA	12,148	Thailand 6,322; Japan 3,329; Hong Kong 2,470.
Wire	NA	72	Sri Lanka 61.
Tubes, pipes, fittings	[e]5,800	[3]11	All to Greece.
Castings and forgings	NA	62	All to Japan.
Unspecified	[e]74,000	NA	
Lead:			
Oxide	517	683	All to U.S.S.R.
Metal including alloys, unwrought	27,089	32,148	All to Japan.
Mercury ---- 76-pound flasks	--	1,979	All to West Germany.
Silver metal, all forms ---- value, thousands	$7,266	[3]$14,779	West Germany $10,122; Austria $2,090.
Tin ore and concentrate	--	4,176	All to Yugoslavia.
Zinc:			
Ore and concentrate	25,510	21,516	Yugoslavia 13,954; Japan 7,562.
Metal including alloys, unwrought	48,103	39,685	Japan 26,448; Hong Kong 4,779; Singapore 4,151.
Other:			
Ash and residue, nonferrous	3,465	2,587	All to Japan.
Base metals, all forms, n.e.s	82	[3]10	All to West Germany.
NONMETALS			
Abrasives, grinding and polishing stones	--	1,280	All to Hong Kong.
Cement, hydraulic ---- thousand tons	231	218	All to U.S.S.R.
Clays and clay products:			
Crude:			
Kaolin	[e]8,060	20,550	All to Japan.
Other	198	50	Do.
Products, nonrefractory	--	[3]1	All to Canada.
Feldspar and fluorspar	9,047	6,844	All to Poland.
Fertilizer, manufactured, nitrogenous	16,162	21,119	U.S.S.R. 15,869; Singapore 5,250.
Graphite, natural	13,896	13,247	Japan 11,957.
Magnesite, including powder	612,078	667,697	U.S.S.R. 478,554; Poland 101,503; West Germany 19,739.
Precious and semiprecious stones ---- value, thousands	--	$3	All to United Kingdom.
Stone, sand and gravel:			
Dimension stone	7,130	7,228	All to Japan.
Quartz and quartzite	1,523	2,357	Do.

See footnotes at end of table.

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Table 2.—North Korea: Apparent exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977[1]	1978[2]	Principal destinations, 1978
NONMETALS —Continued			
Talc	43,695	54,587	Japan 45,590; U.S.S.R. 8,997.
Other, crude	3,384	6,542	Japan 4,766; Hungary 1,776.
MINERAL FUELS AND RELATED MATERIALS			
Coal, anthracite and bituminous	40,060	27,211	All to Japan.

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[e]Estimate. NA Not available.

[1] Unless otherwise specified, data are compiled from the 1977 edition of the World Trade Annual, prepared by the Statistical Office of the United Nations, Walker and Co., New York, 1979, as well as official trade statistics of Hungary, Poland, and the U.S.S.R.

[2] Unless otherwise specified, data are compiled from available trade statistics of individual trading partners.

[3] 1978 edition of the World Trade Annual, prepared by the Statistical Office of the United Nations, Walker and Co., New York, 1980.

[4] Official trade statistics of Japan.

NOTE—Owing to a lack of official trade data published by North Korea, this table should not be taken as a complete presentation of the mineral trade of this country. These data have been compiled from various sources which include United Nations information and data published by the trading partner.

Table 3.—North Korea: Apparent imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977[1]	1978[2]	Principal sources, 1978
METALS			
Aluminum:			
Alumina	--	1	All from Japan.
Metal including alloys:			
Scrap	--	50	All from Singapore.
Unwrought	100	2,271	Yugoslavia 882; Singapore 750; Hungary 550.
Semimanufactures	418	600	Japan 394; West Germany 193.
Antimony metal and regulus	--	200	All from Japan.
Chromium:			
Chromite	10,000	10,000	All from U.S.S.R.
Oxide and hydroxide	--	102	All from Japan.
Cobalt oxide and hydroxide	340	20	Do.
Copper metal including alloys:			
Unwrought	--	1,714	Do.
Semimanufactures	54	419	Japan 409.
Iron and steel metal:			
Scrap	2,356	1,955	All from Japan.
Pig iron	5,799	--	
Ferroalloys	[e]6,220	2,561	Japan 2,347.
Steel, primary forms	467	48	All from Japan.
Semimanufactures:			
Bars, rods, angles, shapes, sections	NA	[3]8,911	France 7,025;[4] Japan 1,884.
Plates and sheets[3]	10,655	12,598	Japan 11,650; France 930.[4]
Hoop and strip	NA	263	Japan 222.
Rails and accessories	NA	496	All from Japan.
Wire	48	738	Do.
Tubes and pipes	2,774	1,555	Japan 1,428.
Unspecified	[e]2,700	NA	
Total	16,137	24,561	
Lead ore and concentrate	7,163	[4]1,300	All from Japan.
Magnesium metal	[3]20	60	Do.
Manganese:			
Ore and concentrate	11,000	21,000	All from U.S.S.R.
Oxide	4	604	All from Japan.
Molybdenum metal kilograms	3	--	
Nickel metal including alloys:			
Unwrought	[e]100	155	Japan 150.
Semimanufactures	[e]141	54	Singapore 50.
Platinum-group metals, unworked or partly worked value, thousands	$147	[4]$7	All from Japan.
Silver, unworked or partly worked do	([5])	[4]$2	Japan $1; Switzerland $1.
Tin:			
Oxide kilograms	[e]560	300	All from Japan.
Metal including alloys, unwrought	--	230	All from Singapore.

See footnotes at end of table.

Table 3.—North Korea: Apparent imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977[1]	1978[2]	Principal sources, 1978
METALS —Continued			
Titanium oxide, dioxide, anhydride	[5]13	13	All from Japan.
Tungsten ore and concentrate	--	293	All from Singapore.
Zinc:			
Oxide	[5]4	18	All from Japan.
Metal including alloys:			
Unwrought	1,542	20	All from Canada.
Semimanufactures	[5]3	1,219	All from Japan.
Other:			
Ores and concentrates	[5]11	--	
Oxides, hydroxides, peroxides	8	1	Do.
Metals:			
Metalloids	--	3	Do.
Base metals, n.e.s	--	20	All from Singapore.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum ... kilograms	--	1,269	All from Switzerland.
Powder of precious and semiprecious stones do	--	1	Mainly from Switzerland.
Grinding and polishing stones	6	38	All from Japan.
Boron oxide and acid	[5]1	21	Singapore 20.
Chalk	--	[4]18	All from United Kingdom.
Clays and clay products (including all refractory brick):			
Crude	--	5	All from Japan.
Products:			
Refractory	567	3,074	Japan 2,353; West Germany 690.
Nonrefractory	--	5	All from Japan.
Diamond, gem, not set or strung value, thousands	--	$20	All from Belgium-Luxembourg.
Fertilizer materials, manufactured:			
Potassic	56,100	150,900	U.S.S.R. 140,900.
Other, including mixed	--	202	All from Japan.
Gypsum and plasters	[5]15	1	Do.
Mica, all forms	--	1	Do.
Precious and semiprecious stones value, thousands	--	[4]$10	West Germany $9.
Salt	[5]10	317	All from Japan.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	--	5	Do.
Soda ash	--	1	Do.
Sulfur:			
Elemental	--	7	Do.
Sulfuric acid	--	3	Do.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	401	Do.
Carbon black	--	188	Do.
Coal, anthracite and bituminous	--	16,800	Do.
Coke thousand tons	117	96	Poland 87; Japan 9.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	--	97	Mainly from Singapore.
Distillate fuel oil do	--	388	All from Singapore.
Lubricants do	25	11	Mainly from Singapore.
Other:			
Mineral jelly and wax do	118	2	All from Japan.
Bitumen and other residues do	6	2	Do.
Unspecified do	[e]9,200	NA	

[e] Estimate. NA Not available.

[1] Unless otherwise specified, data are compiled from the 1977 edition of the World Trade Annual, prepared by the Statistical Office of the United Nations, Walker and Co., New York, 1979, as well as official trade statistics of Czechoslovakia, Hungary, Poland, and the U.S.S.R.

[2] Unless otherwise specified, data are compiled from available trade statistics of individual trading partners.

[3] Partial figure; Japan reports additional exports and only in terms of value.

[4] 1978 edition of the World Trade Annual, prepared by the Statistical Office of the United Nations, Walker and Co., New York, 1980.

[5] Official trade statistics of Japan.

[6] Quantity less than 1/2 unit.

NOTE — Owing to a lack of official trade data published by North Korea, this table should not be taken as a complete presentation of this country's mineral trade. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

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COMMODITY REVIEW

METALS

Iron and Steel.—Because of the Government's ambitious program for overall industrial modernization and construction of new facilities, development of the iron and steel industry was a vital part of the last 6-year plan ending in 1977. Mine output capacity of iron ore is around 10 million tons annually. The largest mine, which is at Musan, had been expanded from 5.5 million tons per year to 6.5 million in 1978. Improvements and expansion of the mines at Komdok were also believed to be completed in 1978.

The capacity for crude steel output was around 4 million tons per year. Annual production capacity for the Kimchaek and Nampo steelworks were 1 million tons each. Additionally, Nampo was reportedly to be enlarged to 3 million tons per year sometime during the current economic plan period. Kanson Steelworks has an annual capacity of 700,000 tons, with the remainder of North Korea's output capacity from Hwangae, Kaech'on, Puryong, Pyongyang, and Songjin.

Nonferrous Metals.—The principal nonferrous ore mined in North Korea is lead-zinc from mines at Komdok and Songch'on. The country produces lead and zinc metal for domestic consumption as well as for exports. Some ore is exported, however, primarily to Japan. Refined copper is produced from imported and indigenous ore. Domestic requirements for aluminum are met by metal imports, which provide feed to small remelting and alloying facilities. North Korea's output of tungsten is significant, producing annually about 4% of the world tungsten supply. The country produces small quantities of other metals, but information is lacking or inadequate to make reliable estimates of output levels.

NONMETALS

Cement.—The 1978-79 Central Budget called for a substantial increase in investment for housing and especially for industrial construction and public transportation utilities projects. The 1978 Budget claimed a 32% gain in expenditures for capital investments for the cement industry over the 1977 level. Raw materials for making cement are abundant in North Korea, and annual cement production capacity ranges around 8 million tons. Under the current development plan, North Korea's cement production was to reach 12 to 13 million tons per year by 1984.

Fertilizers.—North Korea produces a variety of chemical fertilizers; current output is probably around 2.5-3.0 million tons per year and was projected to reach 5 million tons per year by 1984. The United Fertilizer plant at Hungnam was the country's largest producer and was adding new facilities for manufacturing carbide, sulfuric acid, and caustic soda.

Magnesite.—North Korea is well known as a producer of magnesite, and current annual output capacity is around 2 million tons per year. The country's largest mine is at Tanch'on, which produces both deadburned and caustic calcined grades of magnesia for refractory and chemical uses. The installation of a 110-meter rotary furnace at Tanch'on was expected to be completed in 1979. The output of magnesia was for domestic consumption as well as for export.

MINERAL FUELS

Coal.—Although North Korea has large reserves of coal and produces around 45 million tons per year, petroleum and natural gas have not been discovered. Domestic demand for petroleum has been met through imports of Taching oil from China and from the U.S.S.R. Chinese oil is processed at Nam Hung, while Soviet imports of crude are processed at a refinery on the east coast.

The country's most important mineral and fuel source is coal. Both anthracite, used for space heating and electrical power generation, and metallurgical-grade bituminous coal are produced. Under the current development plan, coal production was originally to reach 100 million tons by 1984 but was revised to 70-80 million tons. The target for 1977, the last year of the past plan, was 50-53 million tons.

Output from north Hamyong Province had been expanded in line with the expansion of steel production at Kim Chaek. Metallurgical-grade coal is produced in large quantities at Yonghung, Kukdong, Yangjong, Aoji, and Kogonwon. Anju Consolidated coal mine was to be modernized and expanded in 1979 to double the 1978 output. New coal mines were reportedly being developed in Tokchon, Kangdong, Kangso, and Kowon.

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[1] Physical scientist, Branch of Foreign Data.

[2] 1978-1979 Economic Goals. Kita Chosen Kenkyu, Japan, No. 60, June 1979, pp. 22-31.

[3] Mining Annual Review. Mining Journal, June 1979, pp. 443-445.

[4] Asia 1979 Yearbook. Far Eastern Economic Review Limited, Hong Kong, 1979, pp. 216-219.

The Mineral Industry of the Republic of Korea

By E. Chin[1]

During the fourth 5-year Economic Development Plan, the gross national product (GNP) of South Korea was projected to grow at an average annual rate of 9.2% between 1977 and 1981. In current prices, the GNP reached $47.4 billion[2] in 1978, compared with $35.2 billion in 1977 GNP in 1979 was $61.1 billion. In constant 1975 prices, the GNP in 1979 was $30.7 billion, a real growth of 7.1% over that in the previous year, and a growth of 10.9% for the 1977-78 period. In 1978, per capita GNP reached $1,242, an increase of $298 over that in 1977. By sector, output by Korea's primary industry decreased by 2.3%, while the mining-manufacturing and tertiary industries grew by 19.1% and 14.6%, respectively.

At current market prices, the value of input to GNP in 1979 by agriculture, forestry, and fishing was $12.6 billion ($5.8 billion in 1975 constant prices); mining and quarrying, $0.8 billion ($0.4 billion); manufacturing, $16.6 billion ($10.0 billion); and all other, $31.1 billion ($14.5 billion).

Except for coal, tungsten, graphite, and limestone, South Korea's raw materials part of its manufacturing industries is unimportant. On the other hand, individual refining and metal facilities belonging to the various mineral industries are often modern and large by world standards. In real terms, mining output decreased by 0.2% in 1979; it had grown by 2.3% in 1978, and by 9.0% in 1977. Coal mining increased by 0.3%, while metal mining decreased by 6.8%. However, other mining increased by 3.1%. The growth in the manufacturing sector was 12.2% in 1979, compared with 22.7% in 1978 and to 20.4% in 1977. By sector, the growth in light industry was 14.5% in 1978, and in the heavy and chemical industry, 24.8%, compared with 9.5% and 19.5%, respectively, in 1977. In the heavy and chemical industry sector, output of industrial chemicals grew by 15.4% in 1978; petroleum and oil derivatives, 9.9%; and primary iron and steel products, 20.2%.

While South Korea is an industrialized country, its economy is about one-twenty-fifth the size of Japan's GNP. Other than coal, zinc ore, limestone, aggregates, and other nonmetallic minerals, South Korea is dependent on imports of oil, minerals, and other raw materials to sustain the output of its manufacturing sector. Presently, the value of manufacturing is about 18 times the value of indigenous extraction of minerals and fuels, and this ratio can be expected to increase with further development of its export-oriented industries.

Wholesale prices rose 18.7% in 1979 and 11.7% in 1978, compared with 9.2% in 1977, while consumer price increases were 18.3%, 14.4%, and 10.2%, respectively. The advance in prices was attributed to a poor harvest of food grains as a result of poor weather and a concomittant increase in demand for food commodities; supply shortages for some major manufactured goods; and the rise in cost of imports of major raw materials, particularly fuels. Overall prices of imported goods increased by 26.6% in 1979, while the price of export goods escalated by 17.4%.

During 1979, exports totaled $15.1 billion and imports, $20.3 billion. Overall trade for South Korea in 1978 totaled $27.7 billion, comprised as follows: exports, $12.7 billion and imports, $15.0 billion. Commodity exports in 1978 were $210.6 million in excess of the $12.5 billion export target set by the Government at the onset of the year. To boost export sales and to help reduce the trade deficit, the Government concluded

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trade agreements with the Philippines on April 14, 1978, and with Upper Volta on October 10, 1978. A trade, economic, and technical cooperation agreement with Sierra Leone was concluded on May 12, 1979. In addition, there was a series of governmental and nongovernmental economic and trade meetings held during the year with Australia, Austria, Belgium, Brazil, Canada, Denmark, Finland, France, the Federal Republic of Germany, Greece, Indonesia, Italy, Japan, Mexico, the Netherlands, New Zealand, Norway, Saudi Arabia, Spain, Sweden, Switzerland, Taiwan, and the United States.

The Government continued to support local export industries by promoting deferred payment on exports and establishing fair order for export transactions. Moreover, effective on April 1, 1978, 25 foreign currencies were added to the list of legal tenders, increasing the total number to 44. During the year a total of $2.14 billion in the National Investment Fund and in foreign exchange lending funds was released to support export industries. Presently, the Government has designated 12 Korean firms as general trading companies in the country, and in 1978, these companies accounted for exports of $3.9 billion.

On May 1, 1978, 133 items were freed from import restrictions. By liberalizing 151 import items during the year, the number of automatic-approval import items increased from 561 at yearend 1977 to 712 at the end of 1978. Almost all of the hitherto import-prohibited items were virtually transferred to the import-restricted category or to the automatic-approval category.

During 1978, import duties on 48 items (including steel sheets and batteries) were made eligible for installment payments. Additionally, the tariff rates on cement and 18 other items were reduced, and these items were placed in the category of items subject to elastic tariff rates for imports.

In 1978, 11 foreign banks opened branch offices in South Korea, bringing the total of foreign banks with branches in the country to 30. In addition, seven other foreign banks opened representative offices in the country. The number of overseas branches of Korean banks increased by 8 during the year to 15, and overseas representative offices rose by 6 to 18.

South Korea became the second country in East Asia (after Japan) using nuclear power generation with startup operation of the Kori plant in July 1978. The Governments of South Korea and Japan exchanged instruments of ratification on the joint exploration of the continental shelf lying between the two countries on June 22, 1978. During 1978, there was dedication of 14 large-scale plants at industrial sites throughout the country, construction and expansion of 18 large plants, and ground breaking for construction of 10 new plants. A chronology of other notable events in 1978 follows: January 1, the Ministry of Energy and Resources was inaugurated; February 16, the Government adopted a series of guidelines for gradual import liberalization; February 19, the Economic and Social Commission for Asia and Pacific reported that South Korea recorded the highest growth rate in 1977 among developing countries; April 30, the Government proclaimed a 12-mile limit of territorial waters; May 6, site formation was completed for the Yochon petrochemical industry complex; July 1, the Environmental Preservation Law went into effect; October 5, the Nature Preservation Charter was promulgated by the Government; November 16, the first meeting of the Korea-Japan Joint Committee for development of the continental shelf was held in Seoul; and December 3, the third-phase expansion project of Pohang Iron and Steel Company was completed.[3]

During December 1978, the Asian Development Bank (ADB) approved two loans totaling $41 million for minerals and related projects in South Korea. A $33 million loan for project expansion was obtained by five research institutes, to be repaid over 12 years after a grace period of 3 years at an annual interest rate of 7.7%. The recipient institutes included Standards, Shipping and Oceanography, Machinery and Metals, and Energy Management. An $8 million loan was given to the Korean Research Institute of Geoscience and Mineral Resources with the same terms of repayment.

PRODUCTION

South Korea is a major world producer of anthracite, graphite, kaolin, pyrophyllite, talc, and tungsten. Other mineral commodities mined locally include copper, iron ore, fluorspar, lead, zinc, limestone, and salt. The overall mining production index in 1979 was 112.2 (1975=100), compared with 105.3 for metallic minerals and 154.7 for nonmetallic minerals. The coal production index for 1979 was 103.1.[4] In addition, South Korea produces primary metal from imported ores and concentrates, such as alu minum, copper, and iron and steel. Domestic production of limestone is significant, about 22 million tons, and is used primarily in cement manufacture. The domestic capacity to produce cement is around 16.0 million tons. About three-quarters of the cement production is consumed locally with the remainder exported.

There was no domestic production of oil and natural gas. In addition to local coal and hydro and nuclear power generation, Korea imports crude petroleum and coal to meet its energy demand. The production index for oil refining in 1979 was 154.4 (1975=100), an increase of 8.0% from the previous year. South Korea's total oil refining capacity at yearend 1978 by three companies was 580,000 barrels per day, compared to 435,000 barrels per day at yearend 1977. The principal petroleum refinery products during the year were bunker oil, diesel oil, naphtha, gasoline, and heavy oil, in that order.

Sales of domestically produced minerals and metals to foreign markets were estimated to be over $80 million in 1978. By value, the leading mineral export commodities included tungsten ($37.9 million), talc ($9.0 million), agalmatolite ($6.5 million), kaolin ($5.2 million), lead ore ($4.2 million), and graphite ($3.6 million).

Table 1.—Republic of Korea: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum metal, primary	17,946	18,340	20,155	18,100
Antimony, mine output, metal content	11	--	20	NA
Arsenic, mine output, white arsenic equivalent	709	491	548	590
Bismuth metal	174	134	122	180
Cadmium metal, smelter	NA	20	40	60
Copper:				
Mine output, metal content	2,255	1,748	846	600
Metal:				
Smelter	[r]30,900	42,900	52,400	[1]63,100
Refined, including secondary	40,911	52,800	65,442	[1]63,082
Gold metal troy ounces	18,744	21,380	27,392	[1]23,566
Iron and steel:				
Iron ore and concentrate, gross weight thousand tons	755	791	693	456
Pig iron do.	1,937	2,425	2,741	[1]5,063
Ferroalloys do.	65	64	79	[1]79
Crude steel (excluding castings) do.	2,698	2,737	3,138	5,199
Lead:				
Mine output, metal content	14,533	16,552	16,100	13,000
Metal, smelter	7,781	6,742	7,218	7,200
Manganese ore and concentrate, gross weight	1,283	664	747	725
Molybdenum, mine output, metal content	120	101	219	360
Rare-earth metals: Monazite concentrate, gross weight[e]	10	10	10	10
Silver metal thousand troy ounces	[r]1,856	2,104	2,066	[1]2,819
Tin, mine output, metal content	35	15	20	20
Tungsten, mine output, metal content	2,587	2,685	2,601	[1]2,569
Zinc:				
Mine output, metal content	59,136	68,855	66,440	59,000
Metal, primary	27,548	82,756	58,970	63,014
NONMETALS				
Asbestos	4,762	6,180	13,616	14,000
Barite	4,174	2,645	1,605	1,500
Cement, hydraulic thousand tons	11,873	14,196	15,133	[1]16,413
Clays: Kaolin	379,895	356,660	366,370	[1]374,422
Diatomaceous earth	13,483	22,980	18,845	19,000
Feldspar	26,208	49,374	69,200	68,000
Fluorspar, metallurgical grade	30,270	12,981	11,368	9,100
Graphite:				
Crystalline	3,413	3,446	2,534	2,500
Amorphous	38,277	62,509	53,785	44,700
Total	41,690	65,955	56,319	47,200
Kyanite and related materials: Andalusite	520	115	61	45
Lime, slaked thousand tons	[e]110	60	[e]60	60
Mica: Sericite	5,814	10,183	16,923	16,800
Nitrogen: N content of ammonia	602,792	725,188	896,911	910,000
Pyrite, gross weight	1,622	--	--	--
Salt	694,000	794,000	650,000	645,000
Sodium compounds: Sodium carbonate, manufactured	155,457	170,467	176,090	176,000
Stone, sand and gravel:				
Crushed and broken limestone thousand tons	19,099	22,734	24,153	[1]22,111
Quartzite do.	298	333	265	[1]392
Sand (including glass sand) do.	301	335	384	[1]513

See footnotes at end of table.

Table 1.—Republic of Korea: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^p	1979^e
NONMETALS —Continued				
Sulfur:				
S content of pyrite	490	--	--	--
Byproduct:				
Of metallurgy^e	22,000	25,000	25,000	25,000
Of petroleum^e	25,000	25,000	25,000	25,000
Total	47,490	50,000	50,000	50,000
Talc and related materials:				
Pyrophyllite	348,694	433,304	463,005	473,000
Talc	147,774	171,926	202,078	207,000
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	31,646	38,248	51,989	52,000
Coal: Anthracite thousand tons	16,427	17,268	18,054	[1]18,111
Coke do.	960	1,165	1,319	1,400
Fuel briquets: Anthracite briquets do.	13,962	NA	NA	[1]16,942
Peat	^{e}4,000	--	--	--
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	5,332	7,005	7,980	[1]8,712
Jet fuel do.	4,958	5,835	5,290	[1]5,495
Kerosine do.	4,244	4,486	6,743	[1]9,000
Distillate fuel oil do.	25,628	30,400	34,445	[1]37,900
Residual fuel oil do.	68,354	79,860	86,061	[1]91,357
Lubricants do.	952	938	1,204	[1]1,644
Other do.	16,416	24,870	26,410	[1]22,514
Refinery fuel and losses do.	6,523	4,109	5,745	[1]5,900
Total do.	132,407	157,503	173,978	[1]188,180

^{e}Estimate. ^{p}Preliminary. ^{r}Revised. NA Not available.
[1]Reported figure.

TRADE

During 1979, total trade reached $35.59 billion ($15.06 billion for exports and $20.33 billion for imports). The value of imports of mineral products was $4.18 billion of which mineral fuels and related products accounted for $3.77 billion. Exports of mineral products were only $254 million in 1979. The major export categories were textiles ($4.2 billion), base metals ($1.8 billion), mechanical and electrical equipment ($2.0 billion), and vehicles and transport equipment ($1.1 billion).

Overall trade for the Republic of Korea in 1978 was close to $27.68 billion; the value of imports was $14.97 billion, compared with $12.71 billion for exports.[9] By area, exports to Far East and Middle East countries were valued at $5.2 billion; to North and South America, $4.6 billion; Europe, $2.4 billion; Africa, $0.3 billion; Oceania, $0.2 billion; and other, $0.3 billion. By far the largest individual export destinations were the United States, $4.1 billion; Japan, $2.6 billion; and Hong Kong, $0.4 billion. By commodity classifications, exports of textiles were $3.7 billion, by far the largest category, followed by mechanical and electrical machinery and appliances, $1.4 billion; animal and vegetable products, $1.2 billion; and exports of base metals and articles, and vehicles and associated transportation equipment, each category valued at $1.1 billion. The value of exports of mineral products was $267.8 million, and for chemicals $312.7 million.

Imports by area in 1978 were as follows in billion dollars: Far East and Middle East countries, $9.3; Europe, $1.7; North America and South America, $3.4; Africa, $0.4; and Oceania, $0.6. Imports of mechanical and electrical machinery and appliances were the largest categories by value ($[illegible] billion); receipts of mineral products were $2.7 billion; and base metals and semimanufactures, $1.7 billion. Imports of petroleum during 1978 alone were valued at $2.2 billion.

Table 2.—Republic of Korea: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1977	1978
METALS			
Aluminum metal including alloys, all forms		6,703	6,032
Bismuth metal including alloys, all forms		186	28
Copper metal including alloys, all forms		1,087	1,440
Iron and steel:			
Ore and concentrate	thousand tons	2	(1)
Scrap	do.	1	8
Pig iron, ferroalloys, similar materials	do.	34	30
Steel, primary forms	do.	328	166
Semimanufactures:			
Bars, rods, angles, shapes, sections	do.	^{r}122	144
Universals, plates, sheets	do.	^{r}600	904
Hoop and strip	do.	^{r}15	11
Rails and accessories	do.	(1)	2
Wire	do.	^{r}19	28
Tubes, pipes, fittings	do.	272	534
Castings and forgings	do.	32	34
Total	do.	^{r}1,060	1,657
Gold metal	troy ounces	--	6,807
Lead:			
Ore and concentrate		7,640	10,685
Metal, including waste and sweepings		^{r}813	52,222
Molybdenum ore and concentrate		90	120
Nickel metal		37	1,568
Platinum-group metals and silver:			
Ores and concentrates		4,000	2,130
Waste and sweepings	troy ounces	383	58,643
Metals including alloys	thousand troy ounces	^{r}1,052	1,646
Tin:			
Ore and concentrate		36	37
Metal including alloys, all forms		6	19
Tungsten:			
Ore and concentrate		^{r}2,029	2,361
Metal, including waste and scrap		522	612
Zinc:			
Ore and concentrate		48,573	8,118
Oxides and peroxides		613	758
Metal including alloys, all forms		142	8,354
Other:			
Ash and residue containing nonferrous metals		61	--
Oxides, hydroxides, peroxides of metals		20	115
Base metals including alloys, all forms		^{r}66	271
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum		95	--
Grinding and polishing wheels and stones		^{r}72	336
Asbestos		75	10
Cement and clinker		^{r}3,968,560	2,877,783
Chalk		60	23
Clays and clay products:			
Crude:			
Kaolin		104,781	88,112
Other		46,995	36,196
Products:			
Refractory		^{r}542	290
Nonrefractory		^{r}118,441	66,545
Diamond:			
Gem, not set or strung	value, thousands	$28,210	$54,105
Industrial	do.	$16,691	$2,977
Diatomaceous earth		50	60
Feldspar		14,091	22,080
Fluorspar		3,864	1,152
Fertilizer materials, manufactured, nitrogenous		632,744	1,121,391
Graphite, natural		64,644	50,307
Gypsum and plasters		71,916	1[illegible],095
Lime		2,286	480
Magnesia		2,100	550
Mica, all forms		1,787	1,110
Pigments, mineral: Processed iron oxides		15	--
Precious and semiprecious stones, including synthetic, except diamond[2]	kilograms	65	70
Pyrite		2	--
Salt		328	1,111
Sodium and potassium compounds, n.e.s		^{r}19,386	2,128

See footnotes at end of table.

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Table 2.—Republic of Korea: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
NONMETALS —Continued		
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked:		
Calcareous	240	530
Slate	10	62
Other	76,420	100,746
Worked:		
Slate	887	210
Paving and flagstone	1,710	765
Other	24,753	20,501
Dolomite, chiefly refractory grade	223,740	107,848
Gravel and crushed stone	4,658	4,072
Limestone	380	36
Quartz and quartzite	124,965	24,589
Sand, excluding metal bearing	26,456	10,074
Sulfuric acid	12	11
Talc, crude and ground (including natural steatite)	82,110	80,454
Other:		
Crude	255,950	282,404
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	6,891	27,537
Slag, dross, and similar waste, not metal bearing	r53,738	73,489
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	--	11
Coal, coke, peat	3,922	2,081
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	39	14
Jet fuel do	729	102
Kerosine do	284	14
Distillate fuel oil do	2,098	82
Residual fuel oil do	63	--
Lubricants do	r20	20
Liquefied petroleum gas do	985	960
Other do	r3,913	1,441
Total do	r8,189	2,660
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	13,780	12,169

r Revised.
[1] Less than 1/2 unit.
[2] Excludes quantities valued at $5,429,512 in 1977 and $5,953,200 in 1978.

Table 3.—Republic of Korea: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS		
Aluminum:		
Bauxite and concentrate	800	1,579
Oxide and hydroxide:		
For use in manufacturing aluminum	82,080	22,421
Other	17,335	20,501
Metal including alloys, all forms	79,937	107,808
Antimony:		
Ore and concentrate	165	180
Metal including alloys, all forms	30	109
Arsenic trioxide, pentoxide, acids	11	22
Beryllium metal including alloys, all forms kilograms	551	--
Chromium:		
Oxide and hydroxide	1,619	1,035
Chromite	2,178	4,730
Cobalt:		
Oxide and hydroxide	25	29
Metal including alloys, all forms	30	34
Copper:		
Ore and concentrate	90,804	58,798
Matte	1,713	419
Metal including alloys, all forms	r58,329	92,111

See footnotes at end of table.

Table 3.—Republic of Korea: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS —Continued		
Gold metal[1] kilograms	3,185	3,450
Iron and steel:		
Ore thousand tons	r3,722	3,623
Metal:		
Scrap do	1,571	1,694
Pig iron, ferroalloys, similar materials do	28	38
Steel, primary forms do	r1,106	1,628
Semimanufactures:		
Bars, rods, angles, shapes, sections do	r376	648
Universals, plates, sheets do	r562	821
Hoop and strip do	r82	186
Rails and accessories do	28	27
Wire do	r51	70
Tubes, pipes, fittings do	152	2,282
Castings and forgings, rough do	16	12
Total do	r1,267	4,046
Lead:		
Oxide	86	176
Metal including alloys, all forms	r26,978	44,420
Magnesium metal including alloys, all forms	306	227
Manganese:		
Ore and concentrate	64,010	127,193
Oxide and hydroxide	1,142	1,260
Mercury 76-pound flasks	1,191	900
Molybdenum metal including aloys, all forms	7	13
Nickel:		
Matte, speiss, similar materials	67	69
Oxide and hydroxide	13	104
Metal including alloys, all forms	1,813	1,694
Phosphorus, elemental	49	17
Platinum-group metals including alloys troy ounces	51,660	440,596
Rare-earth metals including alloys	4	(3)
Selenium, elemental	7	3
Silicon, elemental	332	346
Silver thousand troy ounces	1,498	1,183
Tin:		
Ore and concentrate	519	698
Oxide	1	(3)
Metal including alloys, all forms	4,440	1,623
Titanium:		
Ore and concentrate:		
Rutile	3,220	4,138
Ilmenite	22,292	31,963
Oxide	1,546	1,974
Metal including alloys, all forms	22	3
Tungsten metal including alloys, all forms	29	18
Vanadium pentoxide	80	1
Zinc:		
Oxide	335	356
Metal including alloys, all forms	r20,709	25,852
Zirconium ore and concentrate	627	972
Other:		
Ores and concentrates of base metals	20	31
Ash and residue containing nonferrous metals	140	493
Metals including alloys:		
Metalloids	r21	36
Pyrophoric alloys	3	5
Base metals including alloys, all forms	r221	127
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	1,842	2,090
Dust and powder of precious and semiprecious stones, including diamond kilograms	r61,341	6,709
Grinding and polishing wheels and stones	2,408	730
Asbestos	70,255	48,898
Boron materials:		
Crude natural borates	145	396
Oxide and acid	1,594	1,664
Cement, hydraulic	1,992	509,347
Clays and clay products (including all refractory brick):		
Crude	126,508	40,222
Products:		
Refractory (including nonclay brick)	r46,080	46,539
Nonrefractory	1,086	14,655
Diamond, industrial value	$648,762	$994,288
Diatomite and other infusorial earth	5	--

See footnotes at end of table.

Table 3.—Republic of Korea: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
NONMETALS —Continued		
Fertilizer materials:		
Crude, phosphatic	^r1,176,431	1,496,280
Manufactured:		
Nitrogenous	14,791	12,561
Phosphatic	1,997	20
Potassic	248,122	306,546
Other, including mixed	97	28
Ammonia	364	3,095
Fluorspar	11	1,481
Graphite, natural	3	25
Gypsum and plasters	5,430	4,306
Lime	--	16
Magnesite, crude and calcined, and magnesia clinker	5	26
Mica:		
Crude, including splittings	102	207
Worked, including agglomerated splittings	37	42
Pigments, mineral, including processed iron oxides	382	947
Precious and semiprecious stones, including synthetic, except diamond kilograms	^r726	217
Salt	380,325	387,201
Sodium and potassium compound, n.e.s	^r25,808	61,221
Stone, sand and gravel:		
Dimension stone, crude and partly worked	^r597	1,081
Dolomite, chiefly refractory grade	390	341
Gravel and crushed rock	15	754
Quartz and quartzite	206	276
Sand, excluding metal bearing	495	52,962
Sulfur:		
Elemental	423,072	513,784
Sulfur dioxide	8	29
Sulfuric acid	76	87
Talc, steatite, soapstone, pyrophyllite	51	198
Other:		
Crude	^r4,155	4,739
Slag, dross, and similar waste, not metal bearing	^r70,648	296,948
Oxides, hydroxides, and peroxides of magnesium, strontium, barium	684	2,923
Bromine, iodine, fluorine	^r119	98
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	122	819
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	^r64	44
Carbon black and gas carbon	980	6,160
Coal, all grades, including briquets	2,006,885	2,402,921
Coke and semicoke	93,435	101,106
Gases, rare	^r282	183
Helium	5	10
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	149,423	165,419
Refinery products:		
Gasoline do	^r1,369	--
Kerosine do	([1])	214
Distillate fuel oil do	1	989
Residual fuel oil do	4,655	2,113
Lubricants do	^r7,350	2,973
Petroleum coke do	221	114
Bitumen and other residues do	23	175
Bituminous mixtures, n.e.s do	([1])	1
Other do	210	374
Total do	13,829	6,882

^rRevised.
[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—All of the country's output of primary aluminum was by one company, Aluminium of Korea Ltd. (Koralu), at its plant in Ulsan. Koralu, a 50-50 joint venture of the Korean Industrial Bank and Pechiney Ugine Kuhlmann (Pechiney), has an annual production capacity of 18,000 tons of aluminum metal. The plant uses Soderberg anodes and receives all of its electric energy from the thermal powerplant of Korea Electric Co. Ltd. Koralu imports alumina for its smelter requirements. South Korea's demand for aluminum was estimated around 150,000 tons per year. Korean Industrial Bank was negotiating with Pechiney for possible expansion of the Ulsan smelter to 40,000 tons per year capacity or for the construction of a 100,000-ton-per-year smelter at Onsan by 1983. The latter smelter would use alumina from India and would be designed for eventual expansion to 200,000 tons per year capacity.

Copper.—Production of copper concentrate in 1978 was almost 5,000 tons. The Kumpuk copper mine at Kyunsang Nando accounted for the bulk of the Nation's copper ore output. In 1979, imports of copper ores and concentrates totaled 128,809 tons, of which 78% was supplied by the Philippines. Close to 75% of the total producton in 1978 of electolytic copper was by the Changhang smelter, owned by Korea Mining & Smelting Co. Ltd., which has an annual capacity of 37,700 tons of metal.

An 80,000-ton-per-year smelter-refinery was constructed by a consortium of United Kingdom, Belgian, and Finnish interests at the nonferrous metals industrial complex at Onsan. Construction was completed in 1978, and commissioning of the $184 million smelter-refinery was in early 1979. Onsan Copper Refinery Co. Ltd. is owned 50% by the Korea Development Bank, with the remaining equity held by three private companies. Onsan Copper will produce cathode copper, sulfuric acid, gold, and silver. The smelter-refinery was designed for further expansion to 100,000 tons per year and is a Mechim-designed, Outokumpu-type flash smelter, using Hoboken equipment.

Iron and Steel.—Mine production of iron ore approached 500,000 tons in 1979. Almost half of the domestic mine output was from the Yangyang mine in Kangwon Province, operated by Dai Han Iron Mining Co. Ltd. Domestic mine production constitutes less than 20% of South Korea's requirement for iron ore. In 1979, South Korea imported 6.64 million tons of hematite, mostly from Australia and India, and 0.75 million tons of magnetite, primarily from Peru and India. Imports of coking coal totaled 4.2 million tons and were supplied mostly from Australia, Canada, and the United States, in that order.

Pohang Iron and Steel Co. (Posco), with an annual production capacity of 5.5 million tons of steel, dominates South Korea's iron and steel industry. The other producers were independent producers such as Dongkuk Steel Mill Co., Inchon Iron Works Co., Kuckdong Steel Co., and Pusan Iron and Steel Co.

Posco, the only integrated steel operation in the country, completed its third-stage expansion in early December 1978, bringing its crude steel capacity up to 5.5 million tons per year. Posco's facilities included three blast furnaces; one steelmaking plant with three 100-ton converters and one with two 300-ton converters; and continuous casting hot-rolling, cold-rolling, blooming, and slabbing mills.

A fourth-stage expansion is planned whereby Posco's crude steel output will reach 8.5 million tons in the 1980's. Construction in the fourth phase will include blast furnace No. 4, a second hot-rolling mill, and No. 2 continuous-casting mill.

Lead and Zinc.—Young Poong Mining Co. Ltd. (Young Poong) is the largest lead and zinc producer in South Korea, operating mines at Yeonhua, Boonpyong, and Ulgen. Young Poong produces all of the country's output of lead concentrate and almost all of the total output of zinc concentrate. Lead metal output, around 7,200 tons, was all by the Changhang smelter of Korea Mining and Smelter Co. Ltd. Young Poong operates a zinc refinery at Sokpo. Korea Zinc Co. completed the construction of a 50,000-ton-per-year refinery at Onsan and is owned principally by Young Poong Co. (44.4%), Young Poong Mining Co. (20.5%), and the International Finance Corp. (20.81%). The zinc concentrates, hitherto exported to Japan, would be treated at the new facility. Imports of zinc ores and concentrates were only 42,600 tons in 1979, mostly from Australia. In addition to zinc, the Onsan refinery has the annual capacity to produce 100,000 tons of sulfuric acid and 300 tons of cadmium metal. The estimated cost of the smelter was $100 million, which included ore storage facilities, roaster (350 tons per day), and casting shop. Another 10,000 tons of zinc refining capacity was expected to be added in 1981. During 1978, ground was broken for the construction of Young Poong's 50,000-ton-per-year lead smelter at the Onsan Nonferrous Metal Industrial Complex. Completion of this project was planned for 1980.

Tungsten.—South Korea's production of tungsten concentrate (70% WO_3) was from ores averaging 0.8% to 1.9% WO_3. The Sangdong mine of the Korea Tungsten Mining Co. Ltd. produced about 90% of the country's tungsten output. The remainder of the output was by Chungyang Co., San-Nae mine; Okbang Mining Co. Ltd., Wol-Ak mine; Ssang, Daewha mine; and other small operations. The mill at Sangdong has a capacity to process 2,000 tons of ore per day; the concentrate produced is shipped to Korea Tungsten's plant at Taegu where it is

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processed to produce tungsten powder, carbide, and ammonium paratungstate. South Korea's producton of tungsten constitutes about 8% of the total world output.

Other.—Bismuth concentrates were produced as a byproduct of tungsten processing by Korea Tungsten Mining Co. Ltd. The bulk of silver metal output was by the Changhang smelter of Korea Mining and Smelting and the Boonyong operations of Young Poong Mining. Close to 65% of the country's output of gold metal was from Korea Mining's Changhang smelter. Mine production of other metal values during the year included minor amounts of antimony, arsenic, manganese, molybenite, and tin.

NONMETALS

Cement.—Cement production was by seven companies in 1979. Ssangyong Cement Industries Co. Ltd., the largest cement manufacturer, produced about one-third of the country's total output, followed by Tong Yang Cement Co. and Hanil Cement Manufacturing, which accounted for another third of the country's capacity; the remainder was produced by Sung Shin Cement Co., Hyundai Cement Co., Asia Cement Manufacturing Co., and Koryo Cement Co.

Total industry kiln capacity at the end of 1978 was estimated at 19.0 million tons. Under the fourth 5-year plan, domestic production was expected to reach 23 million tons by 1980. Ssangyong Cement completed the expansion of its Tonghae plant from 2.2 million tons to 5.6 million tons in 1978 and planned further expansion to 8.82 million tons. Sung Shin Cement was completing the expansion of its plant at Tanyang to increase capacity from 1 million tons to 2.1 million tons. Additionally, Tong Yang Cement began the expansion of its plant to more than double its annual output capacity, from 2.6 million tons to 5.4 million tons.

During 1979, South Korea exported close to 1.4 million tons of cement clinker, primarily to Singapore, Hong Kong, and Bangladesh. Shipments of portland cement totaled 1.1 million tons, with Thailand, India, and Iran, in that order, as the principal destinations.

Fertilizer Materials.—Total industry capacity to produce chemical fertilizers is about 1.5 million tons per year, of which nitrogen nutrients account for close to 55% of the total. Currently, domestic consumption is on the order of 900,000 tons per year. The major fertilizer manufacturers in South Korea included Chinhae Chemical Co. Ltd., Hankook Caprolactan Co. Ltd., Korea General Chemical Corporation (State-owned); Kyunki Chemical Co. Ltd., Mamhae Chemical Corp., Posco, Pugnong Chemical Co. Ltd., and Yong Nam Chemical Co. Ltd. During 1979, exports of urea totaled 291,000 tons, mostly to the Philippines and Sri Lanka; fertilizers containing nitrogen, phosphorus, and potassium, 378,000 tons, 61% of which went to Turkey and Iran; and fertilizers containing nitrogen and phosphorus, 166,000 tons, mostly to Iran, Pakistan, and Turkey. The increase in exports of nitrogen fertilizers was due to the startup of Namhae Chemical Co.'s large operation at its major fertilizer complex in Yeochem in February 1977.

Other.—Owing to increased activity in construction and export, cement production increased almost 8% in 1979. Production of agalmatolite and talc increased significantly in 1979. Production of other nonmetallic minerals during 1979 included marine salt, amorphous graphite and crystalline graphite, feldspar, fluorite, diatomaceous earth, asbestos, barite, and andalusite.

MINERAL FUELS

Coal.—Under the Government's energy supply-demand program (1977-81), the average increase in coal demand was set at 9.1% annually. The consumption of anthracite was projected to increase from 23.8 million tons in 1978 to 27.2 million tons in 1979. However, anthracite production during the year was only 18.1 million tons. Imports of anthracite in 1979 totaled about 2,100,000 tons, mostly from the United States, United Kingdom, and unknown sources, in that order. To encourage growth in coal production, the Government's program called for investing 335.9 billion won, including $152.3 million in foreign exchange funds, in the coal mining industry during the current 5-year plan.

Virtually all of the country's production was domestically consumed, primarily for space heating. The estimated anthracite consumption pattern was as follows in percent: general consumers, 91.7%; powerplants, 3.5%; industrial establishments, 4.3%; and other, 0.5%. The Government-owned Dae Han Coal Corp. (DHCC) produced 26% of the country's anthracite output. The major mines worked by DHCC are Jang Seong (the largest), Do Gye, Ham Baeg, Hwa Sun, and Eun Seong. Consolidated coal mines produced about 4 million tons, and the remainder of the output during the year was by small-scale private mines. Total coal reserves in South Korea were estimated to be 1,434 million tons, mainly in Yeonweol, Janseong, Daechen, and Whasom. DHCC holds about 25% ownership of the total reserves, with the remainder in private hands.

Petroleum.—There is no domestic production of oil or natural gas in the Korean Peninsula. South Korea imports all of its oil requirements, mostly in the form of crude petroleum, principally from Saudi Arabia with lesser amounts from suppliers such as Iran and Kuwait. At the end of 1978, South Korea's total oil refining capacity by three refineries was 570,000 barrels per day. Korea Oil Corporation (KOCO) operates an oil refinery with a daily refining capacity of 280,000 barrels at the Ulsan Petrochemical Industrial Complex. The 60,000-barrel-per-day refinery of Kyong-In Energy Company is at Inchon. Honam Oil Refinery Company operates its 23,000-barrel-per-day refinery on the south coast of Yosu.

During 1978, KOCO completed an expansion project to increase its daily refining capacity by 65,000 barrels. Work was virtually completed on the construction of a new 60,000-barrel-per-day refinery at the nonferrous metals industrial complex at Onsan. Construction on this refinery, which is a joint venture between the Ssangyong Business Group and Iranian interests, began in October 1976. Kyong-In expanded its daily capacity at Yosu from 160,000 barrels to 230,000 barrels in 1979.

Most of the petrochemical plants in operation are located at the Ulsan Petrochemical Industrial Complex and at the Yochon Petrochemical Complex. In 1978, a 60,000-ton styrene monomer plant and a 25,000-ton styrene butadiene resin plant were dedicated at Ulsan. Construction of three petrochemical plants, including a 350,000-ton ethylene plant, was underway at Yochon. Additionally, ground was broken in 1978 for construction of a 100,000-ton caprolactan plant at Yochon.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Korean won (W) to U.S. dollars at the rate of W484 = US$1.00 for 1978.

[3] Hapdong News Agency (Seoul) Korea Annual 1978. 688 pp.

[4] Economic Planning Board (Seoul) Korea. Major Statistics of Korean Economy 1979. 233 pp.

[5] Office of Customs Administration (Seoul). Statistical Yearbook of Foreign Trade, 1978. V. 12, 1978, 1293 pp.

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The Mineral Industry of Kuwait

By Candice Stevens[1] and Phyllis A. Lyday[2]

The petroleum sector accounted for approximately 70% of the gross domestic product (GDP) of Kuwait, estimated at $13.7 billion[3] (April 1977-March 1978). During 1978 and $15.6 billion (April 1978-March 1979), Kuwait evidenced the third largest per capita GDP in the world. With the development of Kuwait's major oilfields completed years ago, the Government focused on projects for gathering and processing associated natural gas. Petroleum refining, petrochemicals, and other downstream operations were given high priority in development plans. The current 5-year development plan (1977-1981) projected allocations of $16.6 billion. The major expenditure was to be on infrastructure development—roads, housing, water, and electricity—for a population growing at the rapid rate of 5.5% per year. During 1979, petroleum provided 95% of all Government revenues. Kuwait continued to invest large amounts of oil revenue surpluses, which amounted to approximately 75% of foreign exchange earnings, in U.S. dollars during 1979.

Kuwait continued its large foreign aid program through the Kuwait Fund for Arab Economic Development (KFAED, established 1961) and the Arab Fund for Economic and Social Development. Total allocations through 1979 for the KFAED were approximately $2.0 billion representing over 130 individual loans. In 1978, the Saudi-Kuwaiti Permanent Joint Committee for Coordination and Development of Industrial Cooperation was formed to supervise joint ventures in petroleum coke, cement, and possibly the petrochemical and iron and steel industries. A railroad project linking the United Arab Emirates to Europe via Iraq, Syria, and Turkey had entered the planning stage in April 1979. British Rail's consultant, Transmark, was to work out a feasibility study to fix the railroad itinerary. Plans were made during 1979 to merge Kuwait Petrochemicals Industries Co. (KPIC), Kuwait Oil Co. (KOC), Kuwait National Petroleum Co. (KNPC), and the Kuwait Oil Tankers Co. (KOTC) into a single corporation headed by the oil ministers.

PRODUCTION AND TRADE

In 1978, Kuwait was the fourth largest producer of petroleum in the Middle East including Kuwait's share of production from the partitioned Neutral Zone. Kuwait's 3 refineries had a total capacity of 594,000 barrels per day of refined petroleum products. Other mineral production included small amounts of fertilizer materials and cement. Mineral production in Kuwait is given in table 1.

Kuwait had a balance-of-trade surplus of approximately $7 billion in 1978 owing to large petroleum exports. Three foreign oil companies lifted most of Kuwait's export crude oil and in 1978, boosted their offtake to the maximum allowed under their contracts. Allotments were to Shell Oil Co. (360,000 barrels per day), British Petroleum Ltd. (BP) (450,000 barrels per day), and Gulf Oil Co. (Gulf) (500,000 barrels per day). Japan was Kuwait's largest customer taking 27% of exports.

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In 1978, Kuwait exported refined petroleum products primarily to the Far East (45%) and other Arab countries (23%). Again Japan was the largest single buyer taking 15% of exports. Kuwait also exported a small amount of chemical fertilizer.

Table 1.—Kuwait: Production of mineral commodities

Commodity and unit of measure	1976	1977	1978[p]	1979[e]
NONMETALS				
Cement ---------- metric tons	351,122	329,339	621,334	630,000
Clay products, nonrefractory: Sand-lime bricks ---------- cubic meters	213,553	215,020	262,528	270,000
Lime, hydrated, and quicklime ---------- metric tons	12,301	19,656	3,837	11,700
Nitrogen: N content of ammonia ---------- do	422,000	402,000	431,000	435,000
Salt ---------- do	15,426	16,703	18,973	19,000
Sodium and potassium compounds: Caustic soda ---------- do	6,059	6,499	8,009	8,000
Sulfur:				
Elemental, petroleum byproduct ---------- do	61,000	79,000	100,000	100,000
Sulfuric acid ---------- do	4,825	5,112	NA	NA
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural:[1]				
Gross ---------- million cubic feet	395,805	362,751	392,838	461,000
Marketed ---------- do	196,950	210,510	221,069	275,000
Natural gas liquids:				
Natural gasoline ---------- thousand 42-gallon barrels	5,305	5,638	5,415	6,000
Liquefied petroleum gas (propane and butane) ---------- do	14,543	14,965	13,853	16,000
Total ---------- do	19,848	20,603	19,268	22,000
Petroleum:				
Crude[1] ---------- do	785,656	718,831	777,090	[2]912,65[illegible]
Refinery products:				
Motor gasoline ---------- do	5,841	6,205	7,458	8,700
Jet fuel ---------- do	4,251	4,088	3,104	3,600
Kerosine ---------- do	5,990	3,979	10,608	12,000
Distillate fuel oil ---------- do	31,701	30,222	30,160	35,400
Residual fuel oil ---------- do	62,806	60,006	58,334	68,400
Other:				
Naphtha ---------- do	19,558	18,891	18,581	21,800
Asphalt ---------- do	502	502	729	800
Unspecified ---------- do	1,438	1,303	1,551	1,800
Refinery fuel and losses ---------- do	1,864	1,132	2,660	3,300
Total ---------- do	133,951	126,328	133,385	155,800

[e]Estimate. [p]Preliminary. NA Not available.

[1]Includes Kuwait's 1/2 share of production in the Kuwait-Saudi Arabia Partitioned Zone.

[2]Reported figure.

Table 2.—Kuwait: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS			
Aluminum metal including alloys, unwrought and semimanufactures ----------	283	302	Jordan 83; United Arab Emirates 83; Saudi Arabia 71.
Copper metal including alloys, unwrought and semimanufactures ----------	114	76	Saudi Arabia 60.
Iron and steel metal:			
Scrap ----------	29,351	14,334	Iraq 8,699; Syria 2,745.
Semimanufactures ----------	177,111	178,389	Saudi Arabia 91,549; Yugoslavia 56,762.
Lead metal including alloys, unwrought and semimanufactures ----------	243	319	Do.
Tin metal including alloys, unwrought and semimanufactures ----------	245	--	
Zinc, blue powder ----------	120	317	Do.
Other:			
Nonferrous metal scrap ----------	4,849	8,872	Pakistan 2,215; Turkey 2,215; Syria 2,0[illegible]
Metals including alloys, all forms ----------	[r]2	4	Mainly to Iraq.

See footnotes at end of table.

Table 2.—Kuwait: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
NONMETALS			
Abrasives, natural, n.e.s.: Grinding and polishing wheels and stones	28	28	Mainly to Saudi Arabia.
Cement	166,472	58,058	Do.
Clays and clay products (including all refractory brick):			
Crude: Bentonite	31,188	11,581	Iran 9,740; Saudi Arabia 476.
Products:			
Refractory (including nonclay brick)	892	200	Mainly to Saudi Arabia.
Nonrefractory	3,458	4,922	Saudi Arabia 3,442; Iran 665.
Fertilizer materials:			
Crude	120	141	Saudi Arabia 141.
Manufactured:			
Nitrogenous	521,009	558,159	China, mainland, 196,849; India 100,486; Vietnam 96,950.
Other, including mixed	27	([2])	Mainly to Saudi Arabia.
Ammonia	177,949	141,564	Turkey 63,029; United States 17,201; Italy 16,754.
Gypsum and plasters	284	338	United Arab Emirates 150; Saudi Arabia 139.
Lime	1,314	184	Mainly to Saudi Arabia.
Salt (excluding brines)	2,934	2,001	Lebanon 955; Jordan 460; Saudi Arabia 373.
Sodium and potassium compounds:			
Caustic soda	4,737	3,719	Iraq 2,238; Saudi Arabia 1,320.
Soda ash	129	([2])	All to United Arab Emirates.
Stone, sand and gravel:			
Dimension stone, worked	872	2,025	Saudi Arabia 1,499; Qatar 449.
Gravel and crushed rock	1,458	1,864	Mainly to Saudi Arabia.
Sand	2,981	4,155	United Arab Emirates 2,965; Iran 1,180.
Sulfur:			
Elemental, all forms	92,206	70,436	India 60,307; Turkey 4,000; Japan 2,856.
Sulfuric acid	2,322	3,137	Mainly to Jordan.
Other, crude	739	50	Mainly to Saudi Arabia.
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets	10	4	Saudi Arabia 4.
Petroleum:			
Crude thousand 42-gallon barrels	653,369	588,408	Japan 160,287; United Kingdom 68,370; Netherlands 50,242.
Refinery products:			
Gasoline do.	[r]22,090	25,201	Japan 11,235; Netherlands 4,977; Italy 2,541.
Kerosine and jet fuel do.	[r]7,394	8,572	Pakistan 2,233; Vietnam 1,008; Japan 958.
Distillate fuel oil do.	[r]28,897	27,427	Vietnam 4,642; Federal Republic of Germany 4,420; Pakistan 3,794.
Residual fuel oil do.	[r]47,085	52,562	Japan 13,517; Taiwan 9,089; Australia 4,775.
Lubricants do.	[r]27,502	21,958	Mainly to Saudi Arabia.
Mineral jelly and wax do.	[r]([2])	([2])	All to Saudi Arabia.
Other:			
Liquefied petroleum gas do.	21,206	14,331	Mainly to Japan.
Bituminous mixtures, n.e.s do.	45	5	Saudi Arabia 2; United Arab Emirates 2.
Bitumen and other residues do.	11	43	Mainly to Saudi Arabia.
Total do.	[r]154,230	150,099	
Bunkers:[3]			
Distillate fuel oil do.	2,445	840	NA.
Residual fuel oil do.	17,638	15,115	NA.
Total do.	20,083	15,955	

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[r] Revised. NA Not available.

[1] Includes Kuwait's 1/2 share of exports of the Kuwait-Saudi Arabia Partitioned Zone.

[2] Less than 1/2 unit.

[3] Excludes Kuwait's 1/2 share of exports of the Kuwait-Saudi Arabia Partitioned Zone, which is not reported.

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Table 3.—Kuwait: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS			
Aluminum metal including alloys, unwrought and semimanufactures	4,204	10,749	Turkey 2,839; Japan 1,534; Republic of Korea 1,030.
Copper metal including alloys, unwrought and semimanufactures	884	1,590	United Kingdom 670; Greece 219; United States 203.
Iron and steel metal:			
Scrap	23	814	United Arab Emirates 500; Saudi Arabia 289.
Pig iron, ferroalloys, similar materials	39	140	United Kingdom 85; France 45.
Semimanufactures:			
Bars, rods, angles, shapes, sections	413,062	400,718	Japan 254,275; India 103,575.
Universals, plates, sheets	182,093	162,137	Japan 111,869; India 6,356.
Wire	5,584	8,167	Japan 2,067; China, mainland, 1,897; Republic of Korea 1,528.
Tubes, pipes, fittings	90,679	118,768	India 39,903; Japan 30,065; U.S.S.R. 12,419.
Lead metal including alloys, unwrought and semimanufactures	883	1,604	United Kingdom 841; Yugoslavia 331; Federal Republic of Germany 242.
Nickel metal including alloys, unwrought and semimanufactures	([2])	--	
Silver and platinum troy ounces	5	96	India 96.
Tin metal including alloys, unwrought and semimanufactures	18	39	United Kingdom 21; Japan 10.
Uranium, radium, and thorium, and their alloys value	$7,456	$7,662	United Kingdom $6,547; Federal Republic of Germany $900; United States $206.
Other:			
Nonferrous metal scrap, not subdivided	1,243	4,246	Mainly from Saudi Arabia.
Metals including alloys, unwrought and semimanufactures	276	69	Japan 35; United Kingdom 12.
NONMETALS			
Abrasives, natural, n.e.s.: Grinding and polishing wheels and stones	282	385	Italy 131; Federal Republic of Germany 72; United Kingdom 44.
Asbestos	3,763	8,248	Swaziland 8,248.
Cement	1,562,070	1,421,358	Japan 718,976; Republic of Korea 202,272; India 45,348.
Clays and clay products:			
Crude earth for cement manufacture	12,330	4,130	Saudi Arabia 4,130.
Bentonite	33,822	13,716	Ireland 10,262; Greece 2,574.
Products, refractory (including nonclay brick)	4,298	5,625	India 3,755; United Kingdom 655; China, mainland, 548.
Diamond, gem, not set or strung carats	13,570	147,960	Mainly from India.
Fertilizer materials:			
Crude, natural, all types	6	20	United Kingdom 20.
Manufactured, including mixed	399	418	United Kingdom 242; Federal Republic of Germany 136.
Ammonia	6	267	India 138; United Kingdom 123.
Graphite	100	108	United Kingdom 37; Japan 36; India 30.
Gypsum and plasters	16,859	30,331	Egypt 12,194; Iraq 6,680; Italy 4,934.
Lime	17,085	23,331	Spain 8,804; Lebanon 6,441; Yugoslavia 3,000.
Precious and semiprecious stones, except diamond kilograms	497	647	India 295; France 96; Hong Kong 93.
Salt	5,310	5,186	Saudi Arabia 2,755; Netherlands 1,729; Iran 434.
Sodium and potassium compounds:			
Caustic soda	62	39	United States 29; German Democratic Republic 10.
Soda ash	70	239	United Kingdom 101; German Democratic Republic 55; United States 44.
Stone, sand and gravel:			
Dimension stone, unworked:			
Marble	2,387	2,879	Italy 1,417; Greece 600; Iran 376.
Mosaic stones, pebbles, powder	81,579	112,984	Iran 80,142; Italy 22,916.
Other	6,049	3,831	Syria 1,819; Jordan 1,622.
Gravel and crushed stone	2,520	12,963	Italy 10,331; Jordan 1,165.
Sand	182	1,638	Saudi Arabia 990; Italy 500.
Sulfuric acid	18	73	Japan 24; India 24; United Kingdom 11.
Other:			
Agricultural soil and clay	69	174	Netherlands 111; United Kingdom 39.
Unspecified crude minerals, chalks, colored soil, clay	2,012	2,451	India 685; Netherlands 615; United States 219.
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets	807	676	Japan 200; United Kingdom 196; Iran 97.
Hydrogen, helium, rare gases	r161	201	Japan 139; United Kingdom 59.

See footnotes at end of table.

Table 3.—Kuwait: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum refinery products:[1]			
Gasoline:			
Aviation .. thousand 42-gallon barrels..	[r]2	(2)	NA.
Motor .... do....	[r]5	(2)	NA.
Distillate fuel oil .... do....	[r]26	1	NA.
Lubricants .... do....	[r]191	294	Belgium-Luxembourg 76; United Kingdom 58; Singapore 47.
Mineral jelly and wax .... do....	[r]1	(2)	NA.
Kerosine and white spirit .... do....	[r]339	4	Iran 2; Federal Republic of Germany 1.
Other:			
Bituminous mixtures, n.e.s .... do....	[r]45	35	United States 15; United Kingdom 13.
Bitumen and other residues .... do....	[r]152	77	India 52; Iran 19; Hungary 6.
Total .... do....	[r]761	411	

[r] Revised. NA Not available.

[1] Includes Kuwait's 1/2 share of imports of the Kuwait-Saudi Arabia Partitioned Zone.

[2] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—During 1978, proposals were under study by the Aluminum Extrusion Company for the construction of a plant to produce 6,000 tons per year of aluminum products for domestic use. The $15 million facility would process imported aluminum.

Iron and Steel.—Kuwait Metal Pipe Industries Co. produced spiralweld steel pipes for agricultural and petroleum usages at its works in Safat. Capacity of the plant was 16,000 tons of 20-inch pipes, 30,000 tons of 2 1/2-inch pipes, and 100,000 tons of 48-inch pipes per year. The company was planning to expand the product range to include 40,000 tons per year of galvanized steel sheets. Kuwait Metal Pipe Industries Co. was also considering the construction of a plant to produce 15,000 tons per year of copper rods and wire.

Kuwait Iron and Steel Co. (KISC) issued tenders for the construction of a direct-reduction steelworks at Shuaiba in 1974. However, the project, which was to have a capacity of 400,000 tons per year, was subsequently abandoned. In 1978, KISC conducted studies for a smaller plant to produce rods and bars for construction purposes.

A joint venture was formed during 1979 between Ron River (30%), a subsidiary of Rugby Portland Cement of the United Kingdom, and Mohammad Abdel-Muhsin Kharafi. The venture known as the Kuwaiti Steel Reinforcement Co. will manufacture steel reinforcements for the construction industry.

NONMETALS

Cement.—Kuwait Cement Co. (KCC) held a 45% interest in the Saudi-Kuwaiti Cement Co. which was to construct a 2-million-ton-per-year cement plant in the partitioned Neutral Zone. The plant was scheduled for completion in 1981. Kuwait's cement imports were approximately 700,000 tons per year during 1978 and domestic cement demand was expected to increase rapidly owing to growing construction activity.

Fertilizer Materials.—KPIC produced urea and ammonia products at its facility at Shuaiba. Production capacity of the plant, which began production in 1966, was 660,000 tons of ammonia, 900,000 tons of urea, 130,000 tons of sulfuric acid, and 165,000 tons of ammonium sulfate per year. Production was primarily exported to the Persian Gulf states and Eastern Asia. The Government acquired all shares of KPIC, formerly owned by BP and Gulf, in 1973.

The Government completed feasibility studies for three other petrochemical complexes to be located in Shuaiba. A 333,000-ton-per-year ammonia plant was to begin production in 1981. Total cost of the facility

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was estimated at $110 million. The Government was looking for partners for a $900 million aromatics complex. Annual production capacity was to be 284,000 tons of benzene, 86,000 tons of paraxylene, and 60,000 tons of orthoxylene. A proposed $580 million olefin plant was to have an annual production capacity of 350,000 tons of ethylene, 135,000 tons of ethylene glycol, 130,000 tons of low-density polyethylene, and 325,000 tons of styrene. Negotiations were continuing with Romania regarding the construction of a joint venture petrochemicals facility on the Black Sea coast.

Kuwait and Bahrain signed an agreement to set up a 50-50 joint venture between KPIC petrochemical firms and the Bahrain's National Oil Co. (BANOCO). The plant was estimated to cost $368.4 million and produce 1,000 tons per day each of ammonia and methanol. Production will be exported primarily to South Asia and China.

MINERAL FUELS

Natural Gas.—Approximately 3% of total gas production was used in power generation and desalination plants, 25% was utilized by the oil companies, 9% was reinjected in oilfields, and the remainder was flared. Natural gas reserves in Kuwait and the partitioned Neutral Zone were estimated at 1,065 billion cubic meters.

Exploration continued for nonassociated gas, which would provide a source of energy for electricity and desalinated water production independent of oil production. In 1978, a test well was drilled in Burgan Field to a target depth of 20,000 feet, but a fire at 9,000 feet prevented further drilling. Deep drilling was to be resumed in other areas to explore the Persian Khuff Zone which underlay Kuwait's oilfields. At yearend 1978, Kuwait began negotiations with Saudi Arabia for rights to exploit the large nonassociated gas deposits in offshore Dorra Field located in the partitioned Neutral Zone. At yearend 1979, no further details were available.

Kuwait produced liquefied petroleum gas (LPG) at its fractionator at Mina al-Ahmadi refinery. A new facility to produce 3.6 million tons per year of gas liquids officially opened at Shuaiba in early 1979. Production was to consist of propane, butane, and natural gasoline. As the facility was designed to utilize more natural gas than was being produced, Kuwait initiated discussions with Saudi Arabia regarding the use of associated gas from the Khafji Field in the Neutral Zone. Sales contracts for the purchase of LPG for a 10-year period were concluded during 1978 with Shell Oil Co. (200,000 tons per year), Idemitsu (440,000 tons per year), and Bridgestone Liquefied Gas Ltd. (500,000 tons per year) and during 1979 with Marubeni (120,000 tons per year). In general, the Government's target has been to have around 50% of the LPG contract volumes moving in Kuwaiti tankers. During 1979, KOTC took delivery of 3 72,000-cubic-meter gas carriers and had one carrier on order.

Petroleum.—Petroleum production reached a peak of nearly 3.3 million barrels per day in 1972 but thereafter the Government placed a production ceiling of 2 million barrels per day on the major oil producers. During 1979, Kuwait announced plans to cut oil production by 500,000 barrels per day before 1985. Petroleum reserves were reported by the Government at 72 million barrels including the Neutral Zone. Kuwait's petroleum reserves were the third largest in the world after the U.S.S.R. and Saudi Arabia.

Production from the fields operated by KOC averaged 1.9 million barrels per day in 1978. Previously owned by BP and Gulf, KOC was nationalized by the Government in 1975. BP and Gulf continued to operate facilities and provide technical assistance in exchange for a discount on crude oil liftings. KOC began production in 1938 with the discovery of Burgan Field, which proved to be one of the world's largest. The major producing KOC fields were Burgan, Magwa, Ahmadi, Umm Gudair, North Kuwait, and Minaqish.

In the Neutral Zone, the offshore concessionaire for both Kuwait and Saudi Arabia was the Arabian Oil Co., Ltd. (AOC, Japan). AOC production in 1978 was from the Khafji and Hout Fields. Output was evenly divided between Kuwait and Saudi Arabia. AOC planned to increase production to 450,000 barrels per day by yearend 1979 to meet increased Japanese demand. The onshore concessions of American Independent Oil Co. (AMINOIL) were acquired by KOC in April 1978. Production was from the South Fuweis and South Umm Gudair Fields.

Kuwait produced approximately 400,000 barrels per day of refined petroleum products from its 3 refineries in 1978. Total production capacity was about 600,000 barrels per day. Domestic consumption of refined products averaged 30,000 barrels per day. The oldest and largest refinery, located at Mina al-Ahmadi, was operated by KOC. Production capacity was 250,000 barrels per day but the plant was operating at half capacity in 1978. Plans were approved during the year to modernize the refinery at a cost of $300 million. No further details were available by yearend 1979. The Government-owned KNPC operated the Shuaiba refinery during 1978 with a new lube-oil blending unit of 540 barrels per day capacity and a new hydrocracker of 42,000 barrels per day capacity.

The Kuwait Government was considering several joint venture refinery projects, most notably with South Korea, Oman, and Ras al-Khaimah, a member of the United Arab Emirates. Kuwait's support of a $700 million oil refinery on the Indonesian island of Batam will depend upon the result of a feasibility study. Kobe Steel (Japan) had a contract to build a $20 million oil gathering center with basic engineering provided by the Bechtel Corp. (United States). KOTC signed letters of intent with Japanese yards for four 80,000-deadweight-ton tankers worth $100 million. Two vessels will be built by Mitsubishi Heavy Industries and two by Sasebo Heavy Tankers. The four tankers are scheduled for delivery in 1981-82. KOTC had 10 crude carriers in operation with a total capacity of 2,130,000 deadweight tons by yearend 1979. The Government took over the 51% share of KOTC still in private hands during 1979 by payment of $145.6 million.

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[1] Economist, Branch of Foreign Data.

[2] Physical scientist, Branch of Foreign Data.

[3] Where necessary, values have been converted from Kuwait dinars (KD) to U.S. dollars at the rate of KD1 = US$3.45 for 1978 and KD1 = US$3.58 for 1979.

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The Mineral Industry of Liberia

By Phyllis A. Lyday[1]

In 1978, the Republic of Liberia maintained a world rank of 11th in both iron ore and diamond production. The contribution of mineral exports to the nation's gross domestic product (GDP) of $744 million[2] [3] (at current prices) was 70% in 1978, compared with 43% in 1977. Real GDP grew 1.6% based on 1971 constant prices.

Notable events for 1978 included reestablishing oil refining production subsequent to a 20-month shutdown, obtaining loans to expand output capacity and transmission of the Bushrod Thermal Power Plant, receiving commitments from eight industries to locate on the Liberian Industrial Free Zone on Bushrod Island, and signing a long-term trade agreement between the Liberian Government and the Federal Republic of Germany to provide agricultural products in exchange for the preparation of port facilities and roadbuilding equipment. The Liberian Government continued to encourage exploration and mining by foreign companies.

The public sector of Liberia depended heavily upon foreign aid for infrastructure necessary for mineral development. During 1978, loans for projects included upgrading the St. Paul-Bomi Hills river highway and a hydro scheme study of the Mano River. At yearend 1979, Liberia's debt was $653 million. The debt-servicing rate of 11% was creating a financial strain and Liberia was advised by the International Monetary Fund to reduce its development expenditure.

Liberia Electric Corp. (LEC) was in a grave financial state during 1979. LEC was heavily indebted to overseas institutions and Liberian Refining Company (LRC), which were demanding payment.

During 1979, Liberia had the world's largest merchant fleet; shipping was Liberia's third most important source of income. Liberian shipping was threatened by the United Nations Conference for Trade and Development (UNCTAD), which had initiated phasing out flag of convenience ships, such as the 26,000 vessels carrying 80 million tons, which were registered in Liberia.

Mifergui-Nimba Co. (MIFERGUI), a Guinean company, continued its basic 1976 transportation agreement with Liberian American-Swedish Minerals Co. (LAMCO). LAMCO's railroad was the only means to transport for overseas shipment the high-grade iron ore from deposits at Sempete and Pierre-Richard, Guinea. A feasibility study of the transguinean railroad was completed by MIFERGUI during 1978.

PRODUCTION AND TRADE

Liberia's iron ore production, valued at $274.4 million in 1978, contributed about 37% to the GDP and represented 60% of total export values. The United States continued as Liberia's largest trading partner, importing 25% of Liberia's total exports during 1978. Despite increases in world production of steel, the European steel market remained depressed. Several Liberian iron ore mines operated below capacity in efforts to prevent large layoffs despite financial losses incurred during 1978 and 1979. The Government continued to encourage Liberianization of the workforce.

Liberia was adversely affected by the prolonged world recession, which resulted

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in price reductions in the steel industry, and the decline of the U.S. dollar, which left the country less able to buy equipment and machinery. Liberian companies raised prices of iron ore 8% at yearend 1978. The depressed iron ore market, along with uncertainty about future recovery, led to deferral of investments for new projects, cutbacks in production, and closure of some mines. Trade deficits continued, and the growth rate of the economy slowed in 1978 from the previous average of 5%. The European Community Commission, executive body of the European Economic Commission, transferred $10.5 million to Liberia during 1979 under the Lome Convention's Stabex system to compensate for a drop in revenues from iron pellet exports during 1978.

Diamonds valued at $30.3 million contributed 6% to the value of total exports in 1978, which was a 41% increase over the value of 1977 production. Speculation in the diamond market produced a 30% increase in the price of diamonds during 1978. In recent years, mines have operated at a loss as a result of adverse conditions in the world diamond market. The buoyant world demand for diamonds in 1977 was expected to have a favorable impact on Liberian production and exports in the future.

Table 1.—Liberia: Production of mineral commodities

Commodity[1] and unit of measure	1976	1977	1978[p]	1979[e]
METALS				
Gold[e] troy ounces	(2)	(2)	--	--
Iron ore thousand metric tons	18,814	18,136	18,600	20,300
NONMETALS				
Cement, hydraulic do.	[e]100	[e]100	132	146
Diamond:				
Gem thousand carats	163	163	128	130
Industrial do.	162	163	180	180
Total do.	325	326	308	310
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	326	--	112	NA
Jet fuel do.	258	--	45	NA
Kerosine do.	79	--	24	NA
Distillate fuel oil do.	1,309	NA	166	NA
Residual fuel oil do.	1,498	--	317	NA
Other do.	21	--	18	NA
Refinery fuel and losses do.	208	--	71	NA
Total do.	3,699	NA	753	4,100

[e]Estimate. [p]Preliminary. NA Not available.

[1] In addition to the commodities listed, a variety of crude construction materials (clays, stone,and sand and gravel) were produced, but available information is inadequate to make reliable estimates of output levels.

[2] Revised to none.

Table 2.—Liberia: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Iron and steel:			
Ore and concentrate thousand tons	17,663	20,805	West Germany 6,336; Italy 3,610.
Scrap	1,499	2,522	Italy 1,300; Switzerland 1,200.
Semimanufactures	1	67	Indonesia 51; Sierra Leone 12.
Lead, unwrought	--	67	Mainly to West Germany.
Other:			
Ores of base metals	--	94	United Kingdom 38; France 32; Italy 24.
Waste and scrap of nonferrous base metals	--	5,896	Italy 3,738; United Kingdom 974.
NONMETALS			
Abrasives, natural: Grinding and polishing wheels and stones value	$4,250	$14,960	United States $14,960.
Cement	--	9	Sierra Leone 8; Guinea 1.
Diamond, industrial carats	326,214	307,377	Belgium-Luxembourg 151,127; United States 83,979.

See footnotes at end of table.

Table 2.—Liberia: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Fertilizer, manufactured, nitrogenous	79	166	Ivory Coast 95; Togo 71.
Salt	([1])	--	
Sodium compounds: Caustic soda	1	--	
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	818	321	Sierra Leone 321.
Kerosine do.	--	1	Guinea 1.
Lubricants do.	--	195	Ivory Coast 136; Sierra Leone 59.
Bituminous mixtures, n.e.s do.	--	12	Ivory Coast 12.

[1] Less than 1/2 unit.

Table 3.—Liberia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS		
Aluminum:		
Oxide and hydroxide	([1])	--
Metal including alloys, all forms	1,106	479
Chromium, oxide and hydroxide	26	NA
Copper metal, including alloys, all forms	239	31
Iron and steel:		
Ore and concentrates	--	5
Scrap	10	--
Pig iron, ferroalloys, and similar materials	4	1,746
Steel, primary forms	170	103
Semimanufactures:		
Bars, rods, angles, shapes, sections	4,447	6,352
Universals, plates, and sheets	8,747	6,495
Hoop and strip	262	35
Rails and accessories	1,325	1,355
Wire	58	174
Tubes, pipes and fittings	3,346	5,080
Castings and forgings, rough	166	11
Lead metal including alloys, all forms	41	34
Mercury 76-pound flasks	3	--
Nickel metal, including alloys, all forms	1	40
Silver, metal including alloys troy ounces	476	1
Tin:		
Oxides	([1])	--
Metal, including alloys, all forms	([1])	--
Zinc metal, including alloys, all forms	10	93
Other:		
Ore and concentrate of nonferrous base metals	([2])	54,286
Nonferrous metal scrap	900	--
Oxides, hydroxides, and peroxides, of metal, n.e.s	151	353
Metals, including alloys, all forms:		
Metalloids	13	--
Alkali, alkaline earth, and rare-earth metals, n.e.s	21	--
NONMETALS		
Abrasives, natural, n.e.s.:		
Grinding and polishing wheels and stones value	$188,512	$260,104
Other do.	$17,222	$16,007
Asbestos	14,742	109
Boron materials: Oxide and acid	32	30
Cement	42,105	153,199
Clays and clay products (including all refractory brick):		
Crude	32,331	7,693
Products:		
Refractory (including nonclay brick)	1,392	193
Nonrefractory	[3]2,886	1,816
Fertilizer materials:		
Natural:		
Nitrogenous	846	1,214
Phosphatic	62	324
Potassic	1	147
Other	2,109	242
Manufactured:		
Nitrogenous	12,758	18,563
Phosphatic	798	2,237
Potassic	1,070	546
Other, including mixed	3,960	4,768
Ammonia	1,398	1,085

See footnotes at end of table.

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Table 3.—Liberia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
NONMETALS —Continued		
Gypsum and plasters	10,928	2,291
Lime	2,073	[illegible]
Mica, worked ... value	--	$4,510
Precious and semiprecious stones, not set or strung ... do	--	$7,761
Salt	4,002	2,431
Sodium and potassium compounds, n.e.s.:		
Caustic soda	1,275	[illegible]
Caustic potash and sodic and potassic peroxides	5	--
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	12,613	48
Worked ... value	$12,892	$33,072
Dolomite, chiefly refractory grade	39,576	46
Gravel and crushed rock	278,539	6,317
Sand, excluding metal bearing	2,666	--
Sulfur:		
Elemental (including unroasted pyrites)	354	610
Sulfuric acid	159	--
Other:		
Crude ... value	$8,354	$178,245
Oxides and hydroxides of magnesium, strontium, barium	20	[illegible]
Bromine, iodine, fluorine	14	--
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	125	--
Carbon black	17	--
Coal and coke, including briquets	291	[illegible]
Hydrogen and other rare gases ... value	$344	--
Petroleum:		
Crude and partly refined ... thousand 42-gallon barrels	--	731
Refinery products:		
Gasoline ... do	579	474
Kerosine and jet fuel ... do	346	410
Distillate fuel oil ... do	2,650	[illegible]
Residual fuel oil ... do	1	1
Lubricants ... do	[4]143	66
Mineral jelly and wax ... do	1	3
Other:		
Liquefied petroleum gas ... do	([5])	2
Nonlubrication oils, n.e.s ... do	([6])	3,237
Unspecified ... do	[7]2	8
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	481	51

NA Not available.
[1] Less than 1/2 unit.
[2] Value only reported at $2,323.
[3] Total reported excludes quantity valued at $33,189.
[4] Total reported excludes quantity valued at $26,498.
[5] Value only reported at $145,464.
[6] Value only reported at $112,822.
[7] Total reported excludes quantity valued at $1,649,443.

COMMODITY REVIEW

METALS

Gold.—During 1978 and 1979, the price of gold per troy ounce quadrupled. No overall gold production figures were available for 1978 and 1979 as gold mining on a small scale was restricted to Liberians. During 1978, licenses were awarded to 20 companies for prospecting and 16 companies to mine gold, including the following companies and individuals with U.S. interest: Delta Engineers Inc. for a gold-diamond deposit in Grand Cape Mount County; Bently International Trading Co. for areas in Grand Gedeh, Sinoe, and Maryland Counties; and Bruce Clayman for areas in Grand Gedeh and Maryland Counties. Discovery Oil Ltd. announced plans to set up a pilot plant to process gold from its Dougbe Creek property on concession number 2. The assay report showed 6.85 troy ounces of gold and 1.7 troy ounces of silver per ton of ore. Clayco Petroleum Corp. owned 80% of a gold concession area with the Government where preliminary exploration proved the existence of gold-bearing gravel. During 1978, the Liberian Minister of Land and Mines proposed to license gold brokers and dealers for the purpose of encouraging the mining and production of gold.

Iron Ore.—Liberian American-Swedish Minerals Co. (LAMCO) was the largest iron ore company in Liberia, accounting for 60% of iron ore mined in 1978. LAMCO was owned by an equal partnership between the Liberian Government and Liberian Iron Ore Limited (LIO). LAMCO (75%) operated LAMCO Joint Venture Operating Co. (LJV) in a partnership with Liberia Bethlehem Iron Mines Company (25%); LAMCO depended wholly upon LJV for its income. In 1978, for the first time, LAMCO operated at a net loss of $16.8 million, compared with a net profit of $9.3 million in 1977. At midyear 1979, LAMCO was still operating at a loss.

Shipment of iron ore, primarily to Europe, increased despite reduced production, because of the reduction of iron ore stockpiles at Buchanan. A 265-kilometer railroad transported the ore from Mount Nimba to Lower Buchanan, LAMCO's port on the Atlantic, where the ore was shipped or stockpiled. The completion of a permanent crushing station at Buchanan, at a cost of $6.6 million, allowed the stockpile of wash lumpy ore to be reduced at yearend 1978 from 2.8 million to 1.7 million long tons. Because of LAMCO's temporary change in market demand from washed lumpy ore to ore fines, the stockpile was expected to be eliminated during 1979 and 1980. Production at the Nimba and Tokadeh mines was 9.3 million tons of ore during 1978.

A total of $9.1 million was spent by LAMCO on property equipment in 1978, compared with $26.4 million in 1977. Capital expenditures for 1979 were estimated at $14 million. Cost eliminated by discounting the pellet plant and by write-offs of related materials and supplies at Buchanan were offset by higher employment cost.

Production at the Nimba mine near the border of Guinea was slower during 1978. Reserves of iron ore were estimated at 115 million tons with an iron content of 63% as of yearend 1978. Proven and minable reserves were estimated at 92 million tons.[4]

Production at the Tokadeh Mine, located 18 kilometers west of the Nimba Mine, was 161,000 tons of run-of-mine ore for customers requiring a high-silica type of material. Reserves of iron ore were estimated at 220 million tons with an iron content of 53%.[5]

Exploration continued on the Liberian side of the Mount Nimba concession areas, which included Mounts Tokadeh (50% Fe), Gangra (54% Fe), Yuellinton (54% Fe), Beeton (49% Fe), and Nimba/Gabhn (65% Fe), and had reserves estimated in million long tons of 219, 104, 76, 18, and 102.5, respectively.[6] It has been estimated that proven iron ore reserves of 535 million tons, having an average iron content of 51%, 438 million tons of minable reserves, and 260 million tons of product exist in the Mt. Nimba areas.[7] During 1978, LAMCO spent $743,000 on exploration as compared with $874,000 during 1977.

A retroactive agreement between LAMCO and the LAMCO Mine Worker's Union cost LAMCO $595,000 and $1 million during 1978 and 1979, respectively. Total cost of the agreement was estimated to be $6.4 million, which included $2.5 million in housing renovation. During 1978, LJV employed 4,546, of whom 54% were Liberians. The Government rejected an LJV proposal and requested the company to file a new proposal to increase the number of Liberians employed at the mine. During 1979, the new proposal demanded by the Government would increase the work force to 70% Liberians. Training programs continued, and about 600 persons participated during 1978. A cooperative program whereby employees could buy their own houses was begun in 1979.

Bong Mining Co. (BMC) was the second largest iron ore producer in Liberia. It accounted for roughly 30% of iron ore mined in 1978. BMC was owned by the Liberian Government (50%), Finsider International S.S. (16.25%), and steel companies from the Federal Republic of Germany through its manager and coordinator Exploration und Bergbau GmbH (33.75%). Production at the BMC open pit mine, located in the Saladea District west of Bong County, was 15 million ton of crude ore in 1978 at capacity level. Reserves of remaining iron ore as of December 1977 were 350 million tons with an average iron content of 38%.[8] Geological investigations of Zaweah II and Bong Peak were continuing to prove the 124 million tons of probable reserves. Of the three new mines planned, at least two were postponed until after the 1980's. BMC's austerity program in progress was plagued by labor discord. BMC reported in September 1977 that it had 3,306 employees, including 380 expatriate staff.

National Iron Ore Co. Ltd. (NIOC) accounted for roughly 10% of iron ore output in Liberia. The low-grade iron ore at Mano River had proved difficult to upgrade. The ore was carried over 77 kilometers of railway, built around 1962, to the now closed Liberian Mining Co. Ltd. (LMC) mine at Bomi Hills. The ore was then carried over a 68-kilometer section of railroad which had carried ore to Monrovia since 1951 and was

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in a dangerous state of disrepair. It was estimated that it would cost up to $3 million to repair or $7 million to replace the St. Paul River bridge. Plans were being made to raise additional financing of $9 million to improve the performance of the mill, renovate the railroad, and purchase additional tracts to increase haulage capacity. NIOC was experiencing financial difficulty during early 1979 and was expecting several loans to secure the company.

Liberian Iron and Steel Co. (LISCO) had a promising project at Wologisi, which was located 216 kilometers from the coast in the northwestern county of Lofa. American Metal Co. Ltd. (AMAX) was originally expected to take part, but announced its withdrawal from the project in 1978. Kawasaki Steel Corp. leads the consortium with C. Itoh & Co., Nisshho Iwai Co. Ltd., Marubeni Corp., and Tomen. The consortium seeks less extensive concessions in return for Government financing of infrastructure. Japan International Corp. Agency (JICA) concluded the exploitation technical study. An investment of $350 million in infrastructure was expected to be required. The mine was scheduled for production of 10 million tons per year of high-grade pellets of 66% iron content in 1983. The ore was to be pumped through slurry pipelines to the coast.

LMC, which ceased production in 1977, decided in 1978 not to try and reclaim the assets to which the Liberian Government laid claim. LMC requested a new concession area at Bie Mountain, about 24 kilometers west of its former Bomi Hills site.

During 1978, Metallurgical and Engineering Consultant Ltd., a subsidiary of Steel Authority of India, concluded a feasibility study concerning an integrated iron and steel plant to process iron ore into pig iron, billets, and rolled products.

Uranium.—A contract to undertake a program of airborne spectrometric surveys for exploration of uranium deposits was awarded by the U.S. company, Western Enterprises, Inc., to Hunting Geophysics Ltd. A target area of 13,000 square kilometers of the 65,000-square-kilometer concession area must be defined within the first 3 years of exploration to keep the concession.

NONMETALS

Barite.—Senwein Mining Co. (SMC), a wholly owned Liberian company, signed a concession agreement with the Liberian Government to mine barite in the Gibi Territory. SMC was expected to enter into a joint venture with Petkon Corp. of Norway.

Cement.—Production of ground clinker by Liberia Cement Corp. continued on Bushrod Island and was the sole source of cement in Liberia. Cement production was 132,488 tons valued at $7.5 million during 1978. During March of 1979, cement prices went up 19% to $3.40 per bag.

Diamond.—During 1978, 40% of the diamond mined in Liberia was estimated to be of gem quality. Production of diamond was confined to the alluvial deposits of the River Lofa Valley in the Saniquellie and Bahn Districts. The major diamond mining areas were Grand Cape and Mount Lofa Counties. In 1978, 1,396 diamond prospecting licenses were issued. Estimates of total undiscovered world resources for 1977 showed 25 million carats in Liberia.[9]

MINERAL FUELS

Liberia Refining Company (LRC) suffered a 20-month shutdown after a fire in December of 1976. Refined products were imported during 1977 with the local market consuming about 13,000 barrels per day. During 1978, LRC was managed by Resources Development Services Inc. of Bloomfield, N.J., which was a subsidiary of Combustion Engineering Inc. Processing of crude began in August 1978, and production averaged 9,000 of the maximum capacity of 15,000 barrels per day. Production increased to 14,000 barrels per day during March 1979. Rationing of mineral fuels was in effect during early 1979 after the refinery reported losing $2 million per month in gasoline subsidies. Gasoline prices went to $1.50 per gallon in June 1979. The Government made a contract with Consolidated Petroleum Industries Inc. (CPI) to expand LRC to 65,000 barrels per day contingent upon securing a government-to-government petroleum agreement. In March of 1979, the Saudi Arabian company Petromin agreed to furnish 4.1 million barrels of oil annually to LRC. Exploration of the Liberian continental shelf revealed oil deposits, but further exploration was necessary to determine if commercial quantities exist.

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[1] Physical scientist, Branch of Foreign Data.

[2] Liberia uses U.S. dollar currency.

[3] U.S. Embassy, Monrovia, Liberia. State Department Airgram A-24, June 5, 1979, 7 pp.

[4] Liberian Iron Ore Limited. Annual Review, 1978, p. 5.

[5] Mining Annual Review (London). June 1978, p. 490.

[6] World Mining. V. 32, No. 8, July 25, 1979, pp. 171-173.

[7] Work cited in footnote 4.

[8] Work cited in footnote 4.

[9] Work cited in footnote 5.

The Mineral Industry of Libya

By Phyllis A. Lyday[1] and Candice Stevens[2]

The petroleum and gas sector contributed 56% to Libya's gross domestic product (GDP) estimated at \$19.8[3] billion in 1978. Libya has maintained an average annual growth of its gross national product of 19% since 1970. Almost all Government revenues and foreign exchange earnings originated in the fuels sector. Petroleum production spurred an increase in per capita income to \$6,500 per year in 1978 and 1979, ranking Libya among the top 15 countries in the world. With a population of only 2.3 million, a primary problem was the lack of skilled labor.

Approximately 35% of Libyan oil production was by foreign companies with foreign participation allowed only in the fuels sector. Since 1973, the Government has proceeded with a policy of progressive nationalization of foreign interests in the country, such as manufacturing, transportation, communication, utilities, and banking. The Libyans did not nationalize the oilfields completely because they needed foreigners to push exploration and to promote enhanced recovery. A Government reorganization in 1978 created the Secretariat of Heavy Industries and the Secretariat of Light Industries to replace the previous secretariats of industry and minerals.

In 1978 and 1979, development activity was structured around the 1976-80 "transformation" plan where investments exceed \$31 billion including \$6 billion for industry, mining, and hydrocarbons. A major concern was boosting oilfield recovery rates by means of secondary and tertiary recovery methods and maintaining overall productive capacity of 2.5 million barrels per day. Other goals were increased gas exploration and the development of downstream operations in refining and petrochemicals.

The first phase of construction of Misratah port, part of the iron and steel complex, was completed in 1979. Work included two breakwaters, a 750-meter platform for container ships up to 11 meters draft, and a 180-meter berth. The work was completed by Projekt Ivan Multinovic (Yugoslavia) under a \$66 million contract signed in February 1973. The project consultant was Rendel, Palmer, and Tritton (United Kingdom). Phase two, a \$77.7 million contract, will be continued by the same firms. Phase one of construction of Derna port has also been completed. Other projects in the infrastructure area included a \$35 million contract to Hamilton, Ontario-Westinghouse Canada Ltd. (Canada) to supply and install three 17,300-kilowatt gas turbine generator powerplants, transformers, and electric switch gear; a \$20 million contract to Energoinvest (Yugoslavia) to supply a 30-kilovolt and 10-kilovolt transformer station and a 30-kilovolt long-distance powerline; a contract to Astaldi Estero (Italy) to construct an airport south of Benghazi; a contract to Devcon International Corp. (United States) to build a 100-kilometer parallel highway and railway that will run to the Tunisian border. The state-owned Imatran-Vima (Finland) was negotiating with the U.S.S.R., which was in overall charge of the project, to build a 400-kilowatt nuclear powerplant in Libya.

During 1979, Kuwait and Libya established a joint Arab investment and banking company with a capital of \$1 billion, half to be provided by both countries. The company was intended to strengthen the Arab presence in international finance markets.

In July 1979, the Government changed its payment policy and informed foreign companies that payment terms for oil would be changed from 60 days to 30 days. The government also asked petroleum companies to pay their royalties on a 30-day basis effective August 1, 1979. The Government continued to negotiate exploration and production sharing agreements with various

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countries and companies. Libya began a policy of ending the crude buying contracts against foreign operators that did not produce adequate secondary, and if necessary tertiary, oilfield recovery programs during early 1980. On December 16, 1979, the Libyan Minister of oil announced plans to decrease production by approximately 400,000 barrels per day beginning on January 1, 1980. The cutback will be effected by production allowables, Sarir Field being the heaviest proportional decrease.

PRODUCTION AND TRADE

Libya's petroleum production averaged about 2 million barrels per day for the last 4 years. Libya's 725-million-barrel annual production during 1978 and 1979 made the country the second largest producer in Africa and the ninth largest producer in the world. The price of the high-quality Zuetina crude at yearend 1978 was $13.90 per barrel and at yearend 1979 was $34.72 per barrel. Libya also produced refined natural gas, artificial fertilizer, and cement. Mineral production is given in table 1.

Libya's balance-of-trade surplus declined from $4.5 billion in 1977 to $3 billion in 1978 owing to large imports of goods and services for its development program. Libya exported nearly 1.8 million barrels per day of crude oil in 1978 earning $8.9 billion in revenue. During 1979, exports to the United States from Libya reached $5.3 billion, and imports from the United States reached $468 million. The United States was Libya's largest customer, receiving 43% of oil exports during 1978. Other prime destinations were Italy (23%) and the Federal Republic of Germany (11%).

In 1978, Libya began exports of ammonia (70,000 tons) to Greece, Spain, and Italy and of methanol (150,000 tons) to the Netherlands, Spain, Turkey, and Italy. During 1979, Libya ranked fourth among liquefied natural gas (LNG) exporters, exporting to Italy and Spain. Under the 5-year plan, exports were expected to increase 8% per year and imports 5% per year leading to a balance-of-payments surplus of $2.5 billion by 1980.

The first example of a joint industrial venture between the Gulf States occurred during 1979. Kuwait and Bahrain signed a joint venture agreement to form a new company, the Bahrain-Kuwait Petrochemical Industries Co. to produce ammonia and methanol from Bahrain's abundant supplies of natural gas. The plant, expected to be onstream by 1985, was to be built at Sitra, Bahrain. The products were to be exported mainly to South Asia and China. Other trade agreements included a cooperative agreement to establish joint companies between Libya and Sudan, especially in the field of metallurgy, and a cooperative agreement guaranteeing Greece 3 million tons of crude oil for a 5-year period and 120,000 tons per day of ammonia for an unspecified period.

Table 1.—Libya: Production of mineral commodities

Commodity[1]		1976	1977	1978[p]	1979[e]
Cement, hydraulic	thousand metric tons	1,500	2,500	3,200	2,721
Gas, natural:					
Gross	million cubic feet	633,798	706,582	750,221	780,000
Marketed[2]	do.	486,605	556,247	562,242	570,000
Gypsum	thousand metric tons	60	290	180	181
Iron and steel: Crude steel, crude[e]	metric tons	10,000	10,000	10,000	10,000
Lime	thousand metric tons	325	1,000	220	225
Nitrogen, N content of ammonia[e]	metric tons	--	--	80,000	90,000
Petroleum:					
Crude	thousand 42-gallon barrels	707,336	753,129	720,875	751,000
Refinery products:					
Gasoline	do.	2,372	2,409	3,189	3,500
Kerosine and jet fuel	do.	2,701	9,672	6,330	6,900
Distillate fuel oil	do.	6,460	9,016	11,936	12,000
Residual fuel oil	do.	6,935	13,067	17,298	17,000
Other	do.	146	219	3,759	2,900
Refinery fuel and losses	do.	147	1,387	1,649	1,600
Total	do.	18,761	35,770	44,161	43,900
Salt[e]	thousand metric tons	10	10	15	10
Sulfur, byproduct of petroleum and natural gas[e]	metric tons	20,000	20,000	20,000	20,000

[e] Estimate. [p] Preliminary.

[1] In addition to the commodities listed, a variety of construction materials (sand and gravel, crushed stone, brick, and tile) is produced, but available information is inadequate to make reliable estimates of output levels. Natural gas liquids are also produced but are blended with crude petroleum and are reported as part of that total.

[2] Includes gas reinjected into reservoirs, if any.

Table 2.—Libya: Crude oil exports, by destination[1]

(Thousand 42-gallon barrels)

Country	1976	1977	1978
Austria	4,795	621	7,373
Bahamas	11,566	15,659	3,869
Belgium-Luxembourg	1,903	840	1,204
Brazil	11,932	10,257	5,512
Bulgaria	1,610	2,154	2,628
Canada	4,575	NA	NA
Denmark	146	NA	NA
France	35,685	28,470	36,610
Germany, Federal Republic of	136,006	120,998	73,730
Italy	126,124	115,012	145,599
Japan	13,469	5,585	620
Netherlands	16,397	13,797	16,826
Romania	12,481	6,424	15,732
Spain	34,770	38,435	39,456
Switzerland	2,745	767	584
Trinidad and Tobago	NA	NA	2,044
United Kingdom	15,299	13,323	9,746
United States	181,573	287,000	281,452
Unspecified	64,780	49,853	24,017
Total	675,856	709,195	667,002

NA Not available.

[1] In addition to the countries listed, crude oil may have been exported to Egypt, Greece, Liberia, Norway, Sweden, Turkey, the U.S.S.R., and Yugoslavia, but information is not available.

Source: Organization of Petroleum Exporting Countries. Annual Statistical Bulletin 1978.

Table 3.—Libya: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	Principal sources, 1977.
METALS		
Aluminum metal including alloys, all forms	4,873	Greece 2,024; Italy 1,976.
Copper metal including alloys, all forms	2,664	United Kingdom 1,337; France 361; Italy 287.
Iron and steel:		
Ore and concentrate	2,844	Mainly from France.
Metal including alloys:		
Pig iron, ferroalloys, similar materials	43	Mainly from West Germany.
Steel, primary forms	4,562	Italy 1,886; Brazil 803; Belgium-Luxembourg 770; West Germany 686.
Semimanufactures:		
Bars, rods, angles, shapes, sections	45,334	Italy 27,337; Spain 4,559.
Universals, plates, sheets	38,303	Italy 13,661; Belgium-Luxembourg 8,638; Japan 3,871.
Hoop and strip	8,373	Italy 5,748; India 904.
Rails and accessories	279	Italy 118; Denmark 58; Yugoslavia 48; Bulgaria 36.
Wire	169,679	Italy 118,104; U.S.S.R. 15,033.
Tubes, pipes, fittings	130,141	West Germany 49,214; Japan 27,945; Italy 16,419.
Castings and forgings, rough	26	Norway 16; Italy 6; West Germany 2; United Kingdom 2.
Lead metal including alloys, semimanufactures	3,423	West Germany 2,163; Italy 470; Yugoslavia 316.
Nickel metal including alloys, semimanufactures	33	Italy 27; West Germany 4.
Platinum-group metals, unworked or partly worked	([1])	All from Switzerland.
Tin metal including alloys, semimanufactures	10	West Germany 5; France 3; Belgium-Luxembourg 2.
Zinc metal including alloys, semimanufactures	1,237	Italy 582; Japan 370.
Other base metals	4	Taiwan 2; Italy 1; Yugoslavia 1.
NONMETALS		
Abrasives:		
Natural, including industrial diamond	66	Italy 55; United Kingdom 6.
Grinding and polishing wheels and stones	391	Mainly from Italy.
Asbestos	2,641	Bechuanaland 1,211; Canada 620; West Germany 600.
Barite and witherite	101	All from West Germany.
Cement	1,598,348	Greece 767,281; Spain 272,406; U.S.S.R. 230,994; Italy 184,968.
Chalk	2	Mainly from Italy.
Clays and clay products (including all refractory brick):		
Crude	20,587	Greece 10,657; Italy 7,286; Bulgaria 2,131.
Products:		
Refractory (including nonclay brick)	5,391	Italy 2,531; West Germany 1,535; Belgium-Luxembourg 626.
Nonrefractory	66,171	Italy 55,358; Spain 6,268.

See footnotes at end of table.

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Table 3.—Libya: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	Principal sources, 1977.
NONMETALS —Continued		
Fertilizer materials, manufactured:		
Nitrogenous	55,599	Belgium-Luxembourg 14,260; Italy 13,558; United Kingdom 8,950; France 7,566.
Phosphatic	7,687	Mainly from Greece.
Potassic	19,960	Italy 11,150; France 8,810.
Other, including mixed	67,120	West Germany 23,700; Italy 20,142; France 11,28
Gypsum and plasters	3,254	Italy 2,563; Greece 400.
Lime	16,128	Greece 8,761; Turkey 4,200; Italy 3,167.
Pigments, mineral	2,067	Italy 700; Greece 606; Belgium-Luxembourg 327; West Germany 226.
Precious and semiprecious stones, worked or unworked value	$176,796	Spain $144,190; Italy $18,207.
Quartz, mica, feldspar, fluorspar, cryolite, chiolite	1,765	India 621; Belgium-Luxembourg 569; West Germany 268.
Salt	4,878	Tunisia 4,379; West Germany 499.
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked:		
Calcareous	22,880	Italy 18,708; Greece 3,857.
Slate	86	All from Italy.
Other	240	Do.
Worked:		
Slate	2,957	Mainly from Italy.
Paving and flagstone	865	Do.
Other	13,645	Italy 11,041; Greece 1,700.
Gravel and crushed rock	67,187	Italy 55,317; West Germany 9,370.
Limestone, except dimension	425	All from West Germany.
Sand, except metal bearing	295	United States 96; United Kingdom 95; France 46.
Sulfur	160	West Germany 124; Italy 35.
Talc, steatite, soapstone, pyrophyllite	407	Norway 290; Italy 76; Australia 40.
Other:		
Crude	90	Turkey 51; Italy 37.
Slag, dross, and similar waste, not metal bearing	6,104	Mainly from West Germany.
Building materials of asphalt, asbestos, fiber cement, and unfired nonmetals, n.e.s	76,244	Italy 22,043; West Germany 19,537; Yugoslavia 11,780.
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	19,733	Spain 16,993.
Coal and coke, including briquets	704	Italy 358; United Kingdom 154.
Gas, hydrocarbon:		
Natural	450	Netherlands 265; France 162.
Manufactured	2	All from West Germany.
Petroleum refinery products:		
Lubricants thousand 42-gallon barrels	10	Italy 5; West Germany 3; United Kingdom 1; United States 1.
Mineral jelly and wax do	([1])	Mainly from Italy.
Other	1,043	Mainly from Spain.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	9	All from Italy.

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—The General Organization for Industrialization was planning a $1 billion aluminum complex for the Zouare port, 100 kilometers west of Tripoli. For operation, Libya was to supply the natural gas and Yugoslavia was to supply the bauxite ore. The complex was to include a refining plant, a power station, and an oil coke plant.

Iron and Steel.—Feasibility studies for the construction of an iron and steel complex at Misurata, 205 kilometers east of Tripoli on the Mediterranean coast, were under consideration by the Libyan Government during 1978. Preliminary work began on the site in October 1979. The estimated cost of the project was $1 billion. Plans called for the construction of a direct reduction steel mill and continuous casting and rolling mills for long and flat products.

Design capacity of 2.5 million tons per year and an initial production of 1.25 million tons per year were planned. The complex was to eventually process iron ore from the deposits at Wadi Shati, located near Sebha in the province of Fezzan. Reserves were estimated at nearly 795 million tons of 50% iron ore.[4] The construction of the necessary infrastructure was estimated at an additional $1 billion. A railroad link with the coast was considered a major cost factor in development of the iron ore deposit. Energy for the plant will be supplied by natural gas piped from the Marsa Brega Oilfields some 400 kilometers to the east.

Uranium.—Exploration for uranium mineralization was being conducted with the assistance of France. A tract in the Kufra area of the Libyan interior desert within the border area of the disputed Aouzou strip was under study. A 200,000-square-kilometer tract in the Muzzuq area (Fezzan) was also under study. In the meantime, Libya received 258 tons of uranium for its developing nuclear program from Niger's French supervised mines.

NONMETALS

Cement.—Cement production capacity in Libya reached 5 million tons per year in 1978. The Benghazi/Hawari cement plant, built by HKD Industrienlagen A.G. (West Germany), was one of the large industrial complexes of Libya. Humboldt Wedag was the equipment supplier, with Prospective Engineering Gestion acting as consulting engineer at the Benghazi plant. The five clinker production lines had a total production capacity of 2 million tons per year. The Hawari facility, on a site adjacent to the Benghazi plant, contained a two-kiln, 1-million-ton-per-year operation which was placed onstream in September 1978. The Central National Organization for Industrialization awarded a turnkey contract to Fives Cail Babcock (France) to construct the second 1-million-ton-per-year cement plant during 1978. Compagnie de Ciments de Suk el Khamis began cement production in June 1977 at a location south of Tripoli with a capacity of 1 million tons per year. Production capacity of the cement plants in Libya with production capabilities planned to begin by 1979 were as follows:

Location	Operator	Start-up date	Capacity (tons per year)
Homs I	National Cement Co.	1968	1,000,000
Al-Homs II	Do.	1978	1,000,000
Benghazi	Libyan Cement Co.	1971	1,000,000
Hawari	Do.	1978	1,000,000
Suk el Khamis	Suk el Khamis General Cement Co.	1977	1,000,000

MINERAL FUELS

Natural Gas.—Libya produced approximately 650 billion cubic feet of natural gas in 1978, 20% of which was flared. Natural gas reserves were estimated at 29,000 billion cubic feet during 1978. Domestic consumption of natural gas accounted for approximately 15% of the nation's total energy consumption. Natural gas usage was expected to increase to 160 million cubic feet per day by 1980.

Esso Standard Libya Inc. continued its development drilling program at the Hateiba gasfield, located north of Nasser Field. Facilities were under construction to produce and deliver 240 million cubic feet per day of non-associated gas to Esso Standard's LNG plant at Marsa el Brega.

In 1978, Nasser Field was the main supplier of associated gas to the LNG plant. Production capacity of the plant was 345 million cubic feet per day. Esso Standard contracted with Snam Progetti, a subsidiary of Ente Nazionale Idrocarburi (ENI) (Italy), for the sale of approximately 245 million cubic feet per day and with Enagas (Spain) for the sale of 110 million cubic feet per day. In 1978, the Libyan Government was negotiating with Esso Standard and its buyers for a price increase over the base price of $1.62 per million British Thermal Units (Btu) agreed upon in 1975. At yearend 1979, LNG exports from the Marsa el Brega plant were $3.20 per million Btu.

Other events pertaining to natural gas during 1978 and 1979 included the following: Azienda Generale Italiani Petroli S.p.A. (AGIP), a subsidiary of ENI, was studying ways to pipe gas to Italy from a major find offshore of Tripoli; Libya consid-

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ered the possibility of using Malaysia's LNG tankers for transporting Libyan gas; Greece and Libya examined the possibility of building a joint natural gas-based plant in Libya to manufacture ammonia for Greece; and Occidental of Libya agreed to sell its interest in Libyan National Methanol Co., a small liquid petroleum gas (LPG) plant, to the Government.

Petroleum.—Petroleum production increased from 1.99 million barrels per day in 1978 to 2.1 million barrels per day in 1979. Production has been reduced since the record of 3.67 million barrels per day in 1970 to conserve resources. Domestic consumption of crude oil was about 23 million barrels per year. Libya's petroleum reserves were estimated at 25 billion barrels. Libya ranked seventh in production among the members of the Organization of Petroleum Exporting Countries.

As a result of the participation and nationalization measures initiated in 1973, Libya nationalized British Petroleum, Amoseas, Bunker Hunt, Shell, Texaco, and Atlantic Richfield Oil Co. assets. Complex negotiations between 1973 and 1975 led to exploration and production sharing agreements (EPSA) between the Government and the eight remaining oil companies, with the Government acquiring a majority share in most ventures. During 1979 the NOC reported cutbacks which averaged 25% to 50% of non equity crude because of overcommitments of crude to third parties by the Government. The Government was pressuring all producers to produce every possible barrel of oil during 1978 and 1979. At yearend 1979, 13 new EPSA contracts were to be finalized. Total commitments for exploration by foreign companies over the next 5 years reached $1 billion. The EPSA sharing patterns vary, according to the prospects of the acreage concerned, 75% to 85% in favor of the Government.

Oasis, which included Continental Oil Co. of Libya, Marathon Petroleum Libya Ltd., and Amerada Hess Corp., was the country's largest producer with output of 680,000 barrels per day in 1978 and 720,000 barrels per day in 1979. The main producing fields of the Oasis group were Gialo, Defa, Waha, and Bahi.

The two subsidiaries of the state-owned National Oil Corp. (NOC), Arabian Gulf Exploration Co. (AGECO) and Umm al-Gawabi, averaged 509,000 barrels per day in 1978. AGECO planned to increase production of the Sarir Field and exploit the Mussalla Field, located northwest of Sarir, to achieve a combined production capacity of 800,000 barrels per day by 1980. A new pipeline was to link the fields to a refinery and terminal at Ras Lanuf via the Nafoora/Amal line. NOC was also planning to develop new fields in the Hamada al-Hamra plateau in western Libya. A contract was awarded to Enterprise (French) to construct a 450-kilometer-long, 18-inch-diameter pipeline to link the new fields to the Zawiyah refinery at a cost of $166 million. Initial output of the field was to be 60,000 barrels per day rising to 120,000 barrels per day. Construction of the pipeline was expected to be completed during 1981.

Occidental Petroleum Corp. (Oxylibya) had an average daily production of 355,000 barrels in 1978. Production from fields in which Oxylibya held a 49% interest averaged 341,000 barrels per day, and the field in which the company held 19% interest produced 14,000 barrels per day. Under the latter agreement, Oxylibya conducted all exploration at its own expense and initially paid 19% of development costs and received 19% of production free of taxes and royalties. The Intisar Field, which reached an 85% recovery rate owing to a new gas injection scheme, accounted for almost all Oxylibya production. The production of crude from Oxylibya's three new fields, Zella, Aswad, and Sabah, began in December 1978. They were linked through Mobil Oil Co.'s pipeline to the terminal at Ras Lanuf. A new well in the Fidda Field tested at about 4,000 barrels per day and contained an estimated 100 million barrels of oil reserves. The field is in an area where Occidental receives 19% of the net income.

AGIP produced 140,000 barrels per day from its single Abu Tiffel Field. The field was linked by pipeline to the export terminal at Zuetina. In May 1978, AGIP negotiated a $250 million 5-year loan with the Libyan-Arab Foreign Bank for increasing its petroleum activities in Libya. In February of 1979, AGIP struck oil in the Mediterranean near Tripoli. AGIP initiated planning for the development of several large offshore finds in the area. CJP Offshore was awarded the contract to design a preliminary drilling and production platform. Actual development of the deposits depended upon the settlement of a dispute between Libya and Tunisia over rights to explore and develop oil in the offshore area bordering both nations. Elf-Aquitaine was also drilling in an offshore concession which adjoined the territorial waters of Tunisia.

Exxon Oil Co. had two petroleum production-sharing agreements with the NOC, Esso Standard (49% Exxon, 51% NOC) and Esso Sirte (24.5% Exxon, 63.5% NOC, 12% Grace Petroleum Corp.). Combined production of the two companies in 1978 was 147,000 barrels per day.

The Amal Field, and to a lesser extent the Ora Field, accounted for Mobil's production of 90,000 barrels per day in 1978. Mobil operated under a production-sharing agreement with the NOC and Gelsenberg AG. During the year, the company was reported to have made several onshore discoveries that could more than offset any decline in future production.

Total (France) relinquished two onshore concessions in 1978 but retained its offshore acreage. The relinquished areas were the 28,500-square-kilometer Hamada tract and the 23,000-square-kilometer Mizeraq tract.

Refining.—Libya produced 35 million barrels of refined petroleum products in 1978 consisting of 40% fuel oil, 30% gas oil, 15% kerosine, and 10% gasoline. Six new refineries have been constructed in Libya since 1970, and three more are planned. Domestic consumption in 1978 totaled 25 million barrels. Production capacity of Libya's seven refineries was approximately 140,000 barrels per day in 1978, distributed as follows:

Refinery	Operator	Capacity (barrels per day)
Zawiyah	NOC	120,000
Nafoora	Amoseas	2,000
Marsa Brega	Esso Standard	8,000
Amal	Mobil	2,000
Intisar	NOC	2,000
Zuetina	Do	3,000
Dahra	Oasis	2,400

The NOC plant at Zawiyah accounted for more than 85% of total production. Commissioned in 1971, with a production capacity of 40,000 barrels per day, the plant was expanded to a capacity of 120,000 barrels per day in June 1977. The Zawiyah refinery supplied most of Libya's oil product requirements with some surplus for export. It employed 700 people, 86% of which were Libyan nationals. Plans were under development to expand production capacity to 180,000 barrels per day by the early 1980's.

The location of the new 220,000-barrel-per-day refinery, to be built by Snam Progetti for the Zavia Refinery Co., was changed from Tobruk to Ras Lanuf. The refinery was to process crude oil from the Sarir and Misla Fields to be completed by 1981. Two other facilities were to be constructed by the early 1980's: A 400,000-barrel-per-day refinery at Zuetina and a 220,000-barrel-per-day refinery at Misratah. When completed, the new refineries would give Libya about 1 million barrels per day of refining capacity.

Petrochemicals.— Sekisui Chemical Co., Ltd. (Japan) undertook an 18-month study to help formulate a petrochemical production policy for the Government. The petrochemical complex at Marsa Brega was progressively coming onstream during 1978 with a $190 million ammonia plant with an initial production capacity of 330,000 tons per year and a methanol unit with a production capacity at 330,000 tons per year. A urea plant was to come onstream in Marsa Brega in 1979. Construction was by Foster Wheeler Italiana (Italy). In midyear 1978 a $150 million contract was awarded to Snam Progetti by NOC for a second 330,000-ton-per-year ammonia plant at Marsa Brega.

A large chemical complex was scheduled to begin production at Abú Kammásh near the Tunisian border. Annual production capacity was to comprise 60,000 tons of polyvinyl chloride, 50,000 tons of caustic soda, and 8,000 tons of liquid chlorine. An additional facility based on the large salt beds around Abú Kammásh was to produce 120,000 tons per year of salt. Construction was by a West German consortium led by Salzgitter Industri bau GmbH.

Three other facilities were under consideration by the Libyan Government. Belleli Industrie Meccaniche (Italy) won a contract for a 330,000-ton-per-year ethylene-based petrochemical complex using naphtha cut from the refinery as feedstock. A synthetic fibers plant was to be built at Ras Lanuf and a 100,000-ton-per-year ethylene dichloride plant was proposed for Abú Kammásh.

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[1] Physical scientist, Branch of Foreign Data.

[2] Economist, Branch of Foreign Data.

[3] Where necessary, values have been converted from Libyan pound-dinars (Lpd) to U.S. dollars at the rate of Lpd0.296 = US$1.00 for 1978 and 1979.

[4] Habashi, F. and F. A. Bassyouni. Mineral Resources of the Arab Countries. Laval University, Quebec, 1979, p. 58.

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[illegible]

[illegible] Exploration Co. [illegible] Canada, [illegible] Field [illegible]

[illegible]

The Mineral Industry of Madagascar

By David E. Morse[1]

Madagascar, the world's fourth largest island, is predominantly an agricultural country with over 80% of the population employed in the agriculture sector. Agriculture contributed over 30% to the nation's gross domestic product (GDP) and accounted for 90% of material exports in both 1978 and 1979. The country's industrial sector was mainly directed at food processing and textiles with small segments dealing in timber, cement, fertilizers, and assembly of cars, bicycles, and radios. The mining industry continued to be a minor contributor to the nation's economy but, as in many developing nations, an important contributor to exports earnings.

Madagascar's major mineral products in 1978 and 1979 were chromite, flake and lump graphite, and phlogopite mica. A wide variety of gem and ornamental stones were also produced mainly for export. Unreported amounts of crude construction materials (clays, sand, stone, and gravel) were also produced for local use. Madagascar had significant resources of nickel, bauxite, iron, coal, bituminous sandstone, ilmenite, zircon, and rutile that were not being exploited in 1978 and 1979. The country has barely begun to realize its mineral potential, both from the exploration aspect and from the point of view of exploitation.

The current development plan, 1978-80, is aimed at increasing food production, reducing unemployment, and developing industry. An annual growth rate in real terms of 5.7% was projected for the duration of the plan, but the long-term goal was an average annual increase of 6.2% in the GDP to the year 2000. The 1978-80 plan provided for investments totaling $1.06 to $1.26 billion[2] to be spent on improving agricultural productively, building schools, processing minerals such as nickel and chromite, constructing roads, and completing of two new hydroelectric power schemes one at Andekaleka-Rogez on the Vohitra River and the other on the Namorona River.

PRODUCTION AND TRADE

Production statistics are given in table 1.

In 1978 and 1979, Madagascar continued to be an important world supplier of quality lump and flake graphite and also of phlogopite mica. Chromite exports valued at nearly $19 million in 1978 and 1979 primarily went to Japan and France. Petroleum products were exported to Comoros, Réunion, and Mauritius. Primary mineral imports were cement, iron and steel products, and crude petroleum. The Government continued its policy to restrict imports to minimize the materials trade deficit, which was $63 million in 1978 and an estimated $78 million in 1979. The latest available mineral trade statistics are given in tables 2 and 3.

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Table 1.—Madagascar: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Beryl concentrate, industrial grade, gross weight	17	[e]15	11	10
Chromite concentrate, gross weight	221,172	164,710	137,552	136,000
Gold, mine output, metal content troy ounces	160	76	125	125
NONMETALS				
Abrasives, natural: Garnet (industrial only) kilograms	4,281	NA	10,500	5,000
Cement, hydraulic	74,000	52,229	66,044	70,000
Clays: Kaolin	25,397	2,152	2,596	2,600
Feldspar kilograms	--	1,093	[e]1,000	1,000
Gem and ornamental stones:				
Agate do.	133,806	147,200	98,400	[2]7,514
Amazonite do.	2,103	133	2,800	[2]1,459
Amethyst:				
Gem do.	--	4,700	26	NA
Geodes do.	1,475	NA	NA	NA
Apatite (ornamental only) do.	5	596	491	[2]175
Aragonite	121	1,366	770	[2]1,120
Beryl kilograms	3	1	1	[2]5
Calcite (ornamental only)	2	--	--	[2]1,973
Celestine kilograms	32,462	19,586	29,582	[2]34,646
Cipoline marble	29,700	12,000	2,136	[2]4,017
Citrine, gem kilograms	18	47	NA	[2]7
Cordierite do.	4,500	49	([3])	[2]188
Garnet:				
Gem do.	6	NA	9	[2]5
Other ornamental do.	1,876	NA	616	[2]1,351
Jasper do.	1,730	8,850	10,300	[2]2,550
Labradorite do.	7,646	4,389	7,504	7,500
Quartz:				
Rose quartz do.	92,450	29,019	64,800	[2]39,082
Geodes do.	600	NA	--	[2]500
Other ornamental do.	1,516	547	3,515	[2]1,239
Rhodonite do.	3,335	--	--	[2]11,990
Tourmaline:				
Gem do.	NA	NA	1,563	[2]734
Other ornamental do.	68,000	NA	1,915	[2]1,184
Graphite, all grades	17,412	15,727	16,625	[2]14,342
Mica, phlogopite:				
Block	7	NA	NA	NA
Splittings	62	1,498	1,566	1,540
Scrap	12	NA	NA	NA
Total	81	NA	NA	NA
Quartz, piezoelectric kilograms	89	115	200	22
Salt, marine	27,300	26,000	30,000	30,000
Stone:				
Calcite, industrial	3,215	46,915	303	NA
Quartz, metallurgical	107	NA	NA	NA
Other: Bastnaesite kilograms	10	19,586	NA	NA
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	920	826	796	800
Kerosine and jet fuel do.	462	425	365	[illegible]
Distillate fuel oil do.	1,160	912	761	[illegible]
Residual fuel oil do.	554	1,419	1,123	[illegible]
Other do.	81	59	87	[illegible]
Refinery fuel and losses do.	1,123	404	428	[illegible]
Total do.	4,320	4,045	3,560	2,800

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[e]Estimate. [p]Preliminary. NA Not available.

[1]In addition to the commodities listed, opal and modest quantities of unlisted varieties of crude construction materials (clays, stone, and sand and gravel) presumably are produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2]Reported figure.

[3]Less than 1/2 unit.

Table 2.—Madagascar: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976
METALS		
Aluminum metal including alloys, all forms	(1)	--
Chromite	85,458	117,414
Copper metal including alloys:		
Scrap and unwrought	65	89
Semimanufactures	(1)	(1)
Iron and steel semimanufactures	9	2
Lead oxide	76	119
Titanium ore and concentrate	7	--
Zinc metal including alloys, all forms	13	25
Other:		
Ores and concentrates	2	(1)
Metalloids	6	(1)
NONMETALS		
Abrasives, natural	9	1
Clays and clay products	9	--
Fertilizer materials, natural and manufactured	1	--
Graphite, natural	17,021	16,370
Mica, all forms	1,318	845
Pigments, mineral, natural	(1)	(1)
Precious and semiprecious stones, except diamond, including quartz crystal and synthetic stones kilograms	420,724	480,292
Salt and brine	1,967	1,845
Stone, sand and gravel	58	140
Talc, steatite, soapstone, pyrophyllite	(1)	--
Other	20,402	19,212
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	502	281
Kerosine do	286	121
Distillate fuel oil do	361	173
Residual fuel oil do	893	909
Lubricants do	2	(1)
Other:		
Liquefied petroleum gas do	(1)	5
Bitumen and bituminous mixtures do	(1)	--
Unspecified do	1,974	(1)
Total do	4,018	1,489

[1] Less than 1/2 unit.

Table 3.—Madagascar: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976
METALS		
Aluminum:		
Oxides and hydroxides	181	8
Metal including alloys, all forms	884	896
Arsenic oxide and acid	2	2
Chromium oxide and hydroxide	3	(1)
Cobalt oxide and hydroxide kilograms	--	15
Copper:		
Ore and concentrate	(1)	--
Metal including alloys, all forms	91	3
Gold metal, unworked and partly worked troy ounces	18,487	1,190
Iron and steel metal:		
Scrap	(1)	--
Pig iron, ferroalloys, similar materials	20	--
Steel, primary forms kilograms	84	39
Semimanufactures	41,298	23,795
Lead:		
Oxides	17	2
Metal including alloys, all forms	405	239
Magnesium metal including alloys, all forms kilograms	34	27
Manganese oxides do	221	80
Mercury 76-pound flasks	2	7
Nickel metal including alloys, all forms kilograms	28	36

See footnotes at end of table.

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Table 3.—Madagascar: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity		1975	1976
METALS —Continued			
Platinum-group metals including alloys, all forms	troy ounces	96	--
Rare-earth metals including alloys, all forms	kilograms	1,140	475
Silver metal including alloys, all forms	troy ounces	4,726	8,127
Tin:			
Oxide		--	(1)
Metal including alloys, all forms		20	8
Titanium oxides		24	10
Zinc:			
Oxide and hydroxide		22	11
Metal including alloys, all forms		164	444
Zirconium ore and concentrate	kilograms	1,013	--
Other:			
Oxides and hydroxides		124	7
Metals including alloys:			
Metalloids		5	9
Pyrophoric alloys		3	2
Metals including alloys, all forms, n.e.s.		14	14
NONMETALS			
Abrasives:			
Crude, natural		6	2
Dust and powder of precious and semiprecious stones	kilograms	58	33
Grinding and polishing wheels and stones		62	44
Asbestos		10	3
Barite		93	15
Boron materials:			
Crude natural borates		131	41
Oxide and acid		3	--
Cement, hydraulic		50,965	22,882
Chalk		120	188
Clays and clay products (including all refractory brick):			
Crude		1,291	31
Products		852	437
Cryolite and chiolite, natural		--	41
Diamond, all grades	thousand carats	160	--
Diatomaceous earth		15	4
Fertilizer materials:			
Crude and manufactured:			
Nitrogenous		4,256	2,105
Phosphatic		4,874	3,380
Potassic		6,687	7,582
Other, including mixed		1,339	1,973
Ammonia		24	43
Graphite, natural		(1)	(1)
Gypsum and plasters		5,298	2,064
Lime		2,546	276
Magnesite		1	3
Mica, crude and worked		4	4
Pigments, mineral, including processed iron oxides		65	29
Precious and semiprecious stones, except diamond, including synthetic	kilograms	3	--
Quartz crystal	do	1	--
Salt and brine		108	17
Sodium and potassium compounds		5,443	2,600
Stone, sand and gravel:			
Dimension stone		--	1
Gravel and crushed rock		1	6
Quartz and quartzite		(1)	--
Sand excluding metal bearing		13	9
Sulfur:			
Elemental, all forms		6	11
Sulfur dioxide		3	2
Sulfuric acid		150	165
Talc, steatite, soapstone, pyrophyllite		59	8
Other:			
Crude		389	879
Oxides and hydroxides of magnesium, strontium, barium		368	(1)
Bromine, iodine, fluorine		(1)	(1)
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		(1)	--
Carbon black		4	5
Coal, all grades, including briquets		19,623	21,384
Coke and semicoke		119	108

See footnotes at end of table.

Table 3.—Madagascar: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity		1975	1976
MINERAL FUELS AND RELATED MATERIALS —Continued			
Hydrogen, helium, rare gases		3	1
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	5,824	4,196
Refinery products:			
Gasoline	do	31	21
Kerosine and jet fuel	do	(1)	(1)
Distillate fuel oil	do	2	3
Residual fuel oil	do	4	--
Lubricants	do	20	9
Other:			
Liquefied petroleum gas	do	(1)	(1)
Mineral jelly and wax	do	23	27
Bitumen, bituminous mixtures, other residues	do	25	45
Unspecified	do	54	110
Total	do	159	215
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		49	344

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Chromite.—A significant and unexplained drop in chromite output was recorded in 1978 and continued through 1979. The state-owned Kromita Malagasy operated the nation's only chromite-producing mines at Andriamena and Befandriana Nord in 1978 and 1979 with most of the output exported to France and Japan. The Government planned to build a 30,000-ton-per-year ferrochrome plant which was to come online in 1982 and use power from the Adekaleka-Rogez hydro-power scheme.

Iron Ore.—A program of drilling, prospecting, and chemical analysis was conducted on the Soalala iron ore deposits in 1977. Further investigations of the Soalala deposits were begun in 1979 by Italsider S.p.A. of Italy. The deposits are located on the island's west coast approximately 150 kilometers south of Majunga and were estimated to contain 300 to 400 million tons of ore.

Other.—No progress on developing the Manantenina bauxite deposits, the Tsaratanana chromite deposits, or the Ambotavy nickel deposit was reported in 1978 or 1979. No developments in exploiting heavy beach sand concentrations near Tamatave and near Ft. Dauphine on the east coast were announced in 1978 or 1979.

NONMETALS

Cement.—E.S. Cement d'Antsirabe awarded a contract to Loesche GmbH for the construction of a new 115,000-ton-per-year cement plant that was scheduled to come onstream in 1981. Madagascar's only operating cement plant at Amoania was not able to supply the nation's requirements, although it operated near capacity in both 1978 and 1979.

Fertilizer Materials.—In December 1978, Ze-Ren, a joint venture of the Madagascar Government and N-Ren International of the United States, began construction of the island's first fertilizer facility. The 100,000-ton-per-year ammonia-urea plant site was located at Tamatave near the nation's only oil refinery, which was to supply naphtha as feedstock for the fertilizer facility's ammonia plant. Completion was scheduled for late 1980.

Graphite.—The graphite industry in Madagascar has remained essentially unchanged for several decades. Quality flake and lump graphite is produced from highly weathered metamorphic rock that typically contains 2% to 7% graphite. Simple washing near the mines upgrades the product to 60% to 65% carbon as graphite concentrate. The concentrate, after removal of lump, is further upgraded by grinding,

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flotation, washing, and drying. Major gangue materials are clays and quartz. Madagascar contains one of the world's largest graphite-bearing horizons. Any significant increase in output depends on the Government's perception of the industry because the present operators were unable or unwilling to invest in new facilities, owing to previous nationalizations of other mining operations and lack of capital.

Mica.—The phlogopite mica-mining district is located in a triangular area of southeast Madagascar near Fort Dauphine. Mica exports of over 1,000 tons in 1978 and 1979 were approximately 15% splittings, 1% or less block, and over 80% scrap or waste. Major importers were Japan, the European Economic Community, and the United States.

MINERAL FUELS

Coal.—In July 1978, Madagascar's Ministry of Economy and Commerce contracted the Polish state-owned company Kopex to complete an economic and technical study on mining coal from the Sakoa formation in south central Madagascar. Sakoa reserves had been reported at over 60 million tons of bituminous coal with a 17% ash content. Total Sakoa resources were estimated to be nearly 1,000 million tons of high-ash noncoking coal.

Petroleum.—Madagascar produced no crude oil in 1978 or 1979 but continued to import and refine petroleum for its own needs and export products to neighboring Indian Ocean island nations. Output of the Tamatave oil refinery was well below the facility's 11,500-barrel-per day-capacity owing to Government import restrictions.

Uranium.—Officials from the National Military Office for Strategic Industries (OMNIS) and the United Nations Development Program (UNDP) signed a protocol agreement, for uranium exploration and exploitation in March 1979. Under the terms of the agreement, Madagascar was to provide services buildings, vehicles, and transport, and the UNDP was to provide the scientific staff and training for OMNIS personnel.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary values have been converted from Malagasy Francs (FMG) to U.S. dollars at a rate of FMG230 = US$1.00 in 1978 and FMG214 = US$1.00 in 1979.

The Mineral Industry of Malaysia

By Edmond Chin[1]

During the 1960-78 period, Malaysia's economic growth averaged 6.4% per year; and by the end of the period, the gross domestic product (GDP) had reached $10.1 billion.[2] The GDP in 1979 was estimated at $10.9 billion, distributed as follows, in million dollars: Mining and quarrying, 545; agriculture, forestry, and fishing, 2,725; construction, 436; manufacturing, 2,071; and other industries, 5,123.[3] [4]

From 1960 to 1970, the mainstays of the mining sector were bauxite, iron ore, and tin. However, the gradual exhaustion of known reserves resulting from mining and the absence of significant new mineral deposits, caused the production of metal ores to decline annually. The most significant declines have been in bauxite output and, especially, iron ore output. Despite favorable prices, mine output of tin has generally declined since 1970. Offsetting the declining output of tin and other minerals, however, were discoveries of new oil wells that were brought into production beginning in the early 1970's. By 1978, output of crude petroleum totaled 218,000 barrels per day compared with 18,000 barrels per day in 1970.

The other components of Malaysia's primary industrial sector are palm oil, rice, rubber, and timber. By tonnage, timber is the largest component of the sector, but in terms of annual growth in output, palm oil leads with an average annual growth rate of 19%. Since 1960, the value added of the manufacturing sector grew at the rate of 11.5% per year, compared with the rate of 5.2% for the agricultural sector. Manufacturing enterprises consisted largely of the electronics, textile, and footwear industries and the processing of agricultural products.

Growth in the construction sector has been at 7.7% per year since 1960. Attempts were being made to develop poorer regions of the country and to quicken the pace of implementing construction in the public sector. Particular attention was directed toward infrastructure development for roads, railways, ports, electricity, and water.

Malaysia's external trade continued to be the most important aspect of its economic activity, with the value of exports and imports each accounting for nearly one-half of the gross national product. Presently, trade duties account for one-third of the country's total Federal Government revenue and over 60% of total indirect taxes. The composition of external trade has changed significantly during the last two decades. Export earnings from rubber and tin accounted for about 69% of the total export value in 1960, but by 1978, these two products accounted for only 33% of the total value. By contrast, the combined share of palm oil, timber, and petroleum exports increased from 11% of the total export value to 39% over the same period. However, manufactured goods were the leading export earner, accounting for 21% of the total export value. The composition of Malaysia's gross exports is given in the following tabulation, in percent of total value of exports:

Sector	1960	1965	1970	1975	1978
Agricultural	66.1	54.5	59.2	52.8	50.6
Minerals	22.2	30.0	25.9	22.6	25.6
Tin	14.0	23.1	19.6	13.1	11.8
Petroleum	4.0	2.3	3.9	9.3	13.2
Other	4.2	4.6	2.4	.2	.6
Manufactures	8.5	12.2	11.9	21.4	21.2
Other exports	3.2	3.3	3.0	3.2	2.6

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There has been a trend in Malaysia toward less reliance on imports of consumer goods and toward increased imports of intermediate and investment goods. The share of consumer goods in total imports fell from about 47% in 1960 to 22% in 1978. During this same period, imports of intermediate goods rose from 28% to 45%, and imports of investment goods rose from 17% to 31%.

The consumer price index (CPI) for Peninsular Malaysia reflected an inflation rate of 1% per year throughout the 1960's. However, price stability was disrupted in 1973 and 1974 by imported inflation averaging 14% per year. Domestic prices stabilized during the 1975-78 period, when the CPI averaged 4.2% annually.

PRODUCTION

On the basis of value, production of crude petroleum was Malaysia's most important mineral commodity. By the second quarter of 1979, production reached 25.8 million barrels, due mainly to higher output from the Pulai, Tapis, and Bekok Oilfields off the shore of Peninsular Malaysia. Crude oil output was small by world standards, however; it amounted to less than 1% of the total world output.

Malaysia is the world's largest producer of tin, accounting for about 25% of the world's output. Metal output of tin in 1978 and 1979 came from the Butterworth and Penang smelters. Production of tin-related minerals included significant quantities of ilmenite, monazite, and zircon. Small quantities of columbite, gold, scheelite, tantalite, wolframite, and xenotime were also produced as tin byproducts. The number of tin-producing operations in 1978 totaled 936, of which 833 were gravel pumps, 53 dredges, and 50 were other types.

Bauxite was produced by one operation in Peninsular Malaysia. Copper was produced by the Mamut Mine in Sabah. There were 8 iron ore operations, and china clay was produced by 13 operations in Peninsular Malaysia. In addition, Malaysia produces small quantities of antimony, barite, kaolin, and manganese.

Malaysia's natural gas production is associated with its crude oil production. Only an estimated 20% of the gas is utilized; the rest is flared.

Table 1.—Malaysia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978ᵖ	1979ᵉ
METALS				
Aluminum: Bauxite, gross weight ..... thousand tons	660	616	615	[illegible]
Antimony, mine output, metal content (Sarawak)	250	ʳ443	485	[illegible]
Columbium and tantalum concentrate, gross weight	46	45	23	[illegible]
Copper, mine output, metal content[e] [3]	18,200	23,000	26,400	[illegible]
Gold, mine output, metal content:				
Malaya ..... troy ounces	3,574	4,172	5,805	5,000
Sarawak ..... do	ʳ964	742	971	1,000
Total ..... do	ʳ4,538	4,914	6,776	6,000
Iron and steel:				
Iron ore and concentrate ..... thousand tons	308	ʳ330	320	[illegible]
Crude steel[e] ..... do	ʳ190	194	203	[illegible]
Manganese ore and concentrate, gross weight	94,112	45,396	42,271	45,000
Rare-earth metals, gross weight:[4]				
Monazite	1,879	1,977	1,263	2,000
Xenotime (yttrium mineral)	139	75	--	NA
Silver, mine output, metal content ..... thousand troy ounces	ᵉ300	ᵉ430	482	[illegible]
Tin:				
Mine output, metal content	63,401	58,703	62,650	64,000
Metal, smelter[6]	ʳ78,017	66,305	71,953	72,000
Titanium: Ilmenite concentrate, gross weight[5]	ʳ179,995	ʳ153,666	186,816	187,000
Tungsten, mine output, metal content	64	99	72	[illegible]
Zirconium: Zircon concentrate, gross weight[5]	3,129	1,810	927	[illegible]
NONMETALS				
Barite	6,096	11,074	5,079	[illegible]
Cement, hydraulic ..... thousand tons	1,739	ʳ1,777	2,196	[illegible]
Clays: Kaolin	26,252	31,856	31,176	[illegible]
Nitrogen: N content of ammonia	42,700	34,000	39,300	40,000

See footnotes at end of table.

Table 1.—Malaysia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural (Sarawak):				
Gross ---------- million cubic feet	104,728	95,850	85,121	[4]105,623
Marketed ---------- do.	[r]22,611	32,755	35,624	[4]39,528
Petroleum:[7]				
Crude ---------- thousand 42-gallon barrels	60,547	66,984	79,160	[4]103,296
Refinery products:				
Gasoline ---------- do.	6,210	6,733	7,517	9,000
Jet fuel ---------- do.	1,550	1,203	1,445	1,700
Kerosine ---------- do.	2,050	2,436	2,311	2,800
Distillate fuel oil ---------- do.	8,900	[r]9,695	11,078	13,000
Residual fuel oil ---------- do.	10,560	14,405	15,912	19,000
Other ---------- do.	4,760	[r]4,809	4,614	5,500
Refinery fuel and losses ---------- do.	510	[r]675	738	900
Total ---------- do.	34,540	39,956	43,615	51,900

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] All production is from Malaya unless otherwise specified.

[2] In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone), salt, and fertilizers are also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[3] Estimates based on exports of copper concentrates.

[4] Reported figure.

[5] Based on export figures.

[6] Includes small amounts of tin from the smelter in Singapore.

[7] Includes production from Malaya and Sarawak.

TRADE

The bulk of Mayaysia's total export earnings was derived from exports of products of the agriculture, forestry, and fishing; mining and quarrying; and manufacturing sectors. Malaysia exports over 95% of its total production of rubber and tin, over 85% of its production of palm oil and petroleum, nearly 60% of its log and timber production, and about 20% of its manufacturing output. These products account for about 95% of the value of total exports. Total exports in 1978 were estimated at $7.8 billion, compared with $6.2 billion for imports.

Tin was the country's fifth largest export earner in 1978 after rubber, timber, petroleum, and palm oil, in that order. Tin exports accounted for almost 12% of the total exports in 1978. Although tin exports had declined in tonnage, the value of tin exports had increased as a result of the increases in tin prices. From 1960 to 1978, the average price of tin increased about fourfold, from $3,000 per ton to $13,000 per ton.

The prominence of petroleum in Malaysia emerged in the 1970's when oil exports increased from $92 million in 1970 to $388 million in 1975 and to $1.03 billion in 1978. These large increases in exports resulted from increased production from wells along the east coast of Peninsular Malaysia and in offshore Sabah and Sarawak. Because of the rising price of oil, petroleum was expected to become Malaysia's single largest export commodity, by value, by 1980.

Japan was the major importer of Malaysian products, with receipts totaling $1.7 billion, and was followed by the United States ($1.4 billion) and Singapore ($1.3 billion). Collectively, these countries comprised 66.5% of Malaysia's total export value. Malaysia's major import sources were Japan ($1.4 billion), the United States ($0.9 billion), Singapore ($0.5 billion), and the Netherlands ($0.5 billion).

Aside from petroleum, the largest growth in imports was in manufactured goods, followed by metal products, construction materials, agricultural products, and miscellaneous machinery. The growth of these imports reflected the current trend favoring imports of semimanufactures and investment goods over imports of consumer goods. More specifically, it reflected Malaysia's emphasis on economic development through investments in agriculture, construction, manufacturing, and infrastructure.

Table 2.—Malaysia: Exports and reexports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity		1976	1977
METALS			
Aluminum:			
Bauxite		523,819	663,760
Alumina		8	5
Metal including alloys:			
Scrap		2,318	810
Unwrought		(2)	1
Semimanufactures		920	1,142
Columbite ore		116	263
Copper:			
Ore		81,354	98,830
Metal including alloys:			
Scrap		1,794	1,782
Unwrought and semimanufactures		840	232
Iron and steel:			
Iron ore	thousand tons	9	141
Metal:			
Scrap		15,993	11,389
Pig iron, ferroalloys, similar materials		288	264
Steel, primary forms		983	104
Semimanufactures:			
Bars, rods, angles, shapes, sections		2,171	2,717
Universals, plates, sheets		r1,811	882
Hoop and strip		390	127
Rails and accessories		345	53
Wire		286	361
Tubes, pipes, fittings		7,210	11,100
Castings and forgings, rough		819	579
Lead:			
Oxide		25	(2)
Metal including alloys, all forms		719	553
Magnesium metal including alloys, all forms		(2)	--
Manganese ore		23,737	12,697
Mercury	76-pound flasks	(2)	7
Nickel metal including alloys, all forms		176	108
Rare-earth metals: Monazite		--	(2)
Silver	troy ounces	4,404	--
Thorium ore		2,018	--
Tin metal including alloys:			
Scrap		4	29
Residues (slag and hardhead)		19,402	--
Unwrought		81,610	65,535
Semimanufactures		1	8
Titanium:			
Ilmenite ore and concentrate		180,005	158,679
Oxide		5	10
Tungsten ore and concentrate		r134	147
Zinc:			
Oxide		160	46
Metal including alloys:			
Scrap		359	340
Blue powder		94	15
Unwrought		87	1
Semimanufactures		347	76
Zirconium ore and concentrate		3,131	1,820
Other:			
Ores and concentrates		725	430
Ash and residue containing nonferrous metals		1,486	928
Oxides, hydroxides, peroxides of metals		--	(2)
Metals including alloys, all forms		17	--
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc		2	1
Grinding and polishing wheels and stones		25	11
Asbestos		35	19
Barite and witherite		1,747	895
Boron materials, crude		4	15
Cement		8,219	14,435
Chalk		1	(2)
Clays and clay products (including all refractory brick):			
Crude:			
Kaolin		11,921	11,845
Bentonite		(2)	(2)
Fuller's earth		--	222
Other		3,725	4,111
Products:			
Refractory		1,451	545
Nonrefractory		9,248	8,571
Diamond	value, thousands	398	819
Diatomite and other infusorial earth		1	(2)
Feldspar, fluorspar, etc		36	5

See footnotes at end of table.

Table 2.—Malaysia: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
NONMETALS —Continued		
Fertilizer materials:		
Crude, phosphatic	70	3,101
Manufactured:		
Nitrogenous	12	307
Phosphatic	7	49
Potassic	1	--
Other, including mixed	33	7,457
Ammonia	190	156
Graphite	10	--
Gypsum and plasters	1,270	86
Lime	17,007	16,575
Pigments, mineral:		
Natural, crude	35	29
Iron oxides, processed	2	7
Pyrite, unroasted	19	--
Salt and brines	1,267	994
Sodium and potassium compounds, n.e.s.:		
Caustic soda	4	--
Caustic potash and sodic and potassic peroxides	18	1
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	7	--
Worked	371	216
Dolomite, chiefly refractory grade	1,011	2,388
Gravel and crushed rock	1,250,185	521,563
Limestone, except dimension	25,626	20,773
Quartz and quartzite	568	2,174
Sand, excluding metal bearing	188,932	227,966
Sulfur:		
Elemental	13	20
Sulfuric acid	199	9
Talc, steatite, soapstone, pyrophyllite	473	161
Other:		
Crude	32	110
Oxides, hydroxides, and peroxides of magnesium, barium, strontium	--	1
Slag, dross, and similar waste, not metal bearing	72	127
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	7	41
Carbon black and gas carbon	17	98
Coal and coal briquets	26	3
Coke and semicoke	96	50
Hydrogen, helium, rare gases ... value	$23,436	$66,865
Petroleum:		
Crude ... thousand 42-gallon barrels	49,472	56,697
Partly refined ... do.	6,169	2,838
Refinery products:		
Gasoline ... do.	113	47
Jet fuel ... do.	1	1
Kerosine ... do.	710	352
Distillate fuel oil ... do.	215	100
Residual fuel oil ... do.	14	--
Lubricants ... do.	235	238
Other:		
Mineral jelly and wax ... do.	(2)	(2)
White spirit ... do.	(2)	1
Nonlubricating oils, n.e.s ... do.	9	6
Bitumen and bituminous mixtures, n.e.s ... do.	6	5
Liquefied petroleum gas[3] ... value	$4,090	$427
Unspecified ... thousand 42-gallon barrels	1,570	1,169
Total[3] ... do.	2,873	1,919
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	343	443

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[r] Revised.

[1] Excludes intrastate trade.

[2] Less than 1/2 unit.

[3] Total excludes liquefied petroleum gas.

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Table 3.—Malaysia: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity		1976	1977
METALS			
Aluminum:			
Bauxite		1,002	590
Oxide and hydroxide		4,201	5,480
Metal including alloys, all forms		16,404	24,201
Antimony metal		60	52
Arsenic trioxide, pentoxide, acid		910	178
Chromium:			
Chromite		135	10
Oxide and hydroxide		47	52
Cobalt oxide and hydroxide		1	1
Columbium and tantalum:			
Ores and concentrates		5	11
Tantalum metal including alloys, all forms		5	11
Copper:			
Ore and concentrate		14	15
Metal including alloys, all forms		8,301	9,844
Iron and steel:			
Ore and concentrate		11	(4)
Metal:			
Scrap		2,777	2,096
Pig iron, including cast iron		7,039	5,193
Sponge iron, powder, shot		173	225
Ferroalloys:			
Ferromanganese		1,824	2,083
Other		1,191	3,043
Steel, primary forms		29,505	14,025
Semimanufactures:			
Bars, rods, angles, shapes, sections		201,202	197,906
Universals, plates, sheets		317,785	379,738
Hoop and strip		13,517	9,847
Rails and accessories		7,691	2,031
Wire		7,715	7,341
Tubes, pipes, fittings		27,998	35,655
Castings and forgings, rough		2,303	1,493
Lead:			
Ore and concentrate		2	40
Oxide		1,300	1,244
Metal including alloys, all forms		4,416	5,066
Magnesium metal including alloys, all forms		2	3
Manganese:			
Ore and concentrate		2,027	2,571
Oxide		986	765
Mercury	76-pound flasks	372	308
Molybdenum metal		13	8
Nickel metal including alloys, all forms		323	600
Platinum group metals including alloys	troy ounces	2,438	3,218
Silver	do	10,016	54,296
Tin:			
Ore and concentrate		12,349	11,406
Slag and hardhead		--	22
Metal including alloys, all forms		372	456
Titanium:			
Ore and concentrate		42	23
Oxide		3,331	8,407
Tungsten ore and concentrate, gross weight		(2)	30
Zinc:			
Ore		29	36
Oxide		200	142
Blue powder		67	79
Metal including alloys, all forms		13,385	13,953
Zirconium ore and concentrate		49	46
Other:			
Ores and concentrates		r3	3
Ash and residue containing nonferrous metals		205	221
Oxides		1	(4)
Metals including alloys, all forms		62	52
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, etc.		212	264
Dust and powder of precious and semiprecious stones	value	$1,118	$2,570
Grinding and polishing wheels and stones		1,223	1,411
Asbestos		19,281	21,141
Barite and witherite		8,271	3,546
Boron materials:			
Crude natural borates		152	67
Oxide and acid		126	11
Cement		342,738	288,943
Chalk		836	136

See footnotes at end of table.

Table 3.—Malaysia: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity		1976	1977
NONMETALS —Continued			
Clays and clay products:			
Crude:			
Bentonite		2,572	1,524
Kaolin		1,544	1,816
Fuller's earth		3,325	7,601
Mullite, chamot, Dinas earth		43	30
Other		13,215	4,924
Products:			
Refractory		10,112	17,766
Nonrefractory		8,135	11,861
Cryolite and chiolite		101	350
Diamond:			
Gem, not set or strung	value, thousands	$1,677	$1,852
Industrial	do	$41	$25
Diatomite and other infusorial earth		178	385
Feldspar		6,333	7,037
Fertilizer materials:			
Crude:			
Nitrogenous		13	287
Phosphatic		152,025	169,303
Potassic		10,716	24,826
Manufactured:			
Nitrogenous		158,861	212,381
Phosphatic:			
Thomas slag		17	71
Other		7,325	15,096
Potassic		229,209	239,726
Other, including mixed		70,061	122,620
Ammonia		3,418	14,204
Fluorspar, leucite, etc		2,533	7,696
Graphite, natural		427	375
Gypsum and plasters		58,645	55,162
Lime		4,299	13,776
Magnesite		333	778
Mica, worked and unworked, including waste		165	89
Pigments, mineral:			
Natural, crude		442	125
Iron oxides		1,162	1,028
Precious and semiprecious stones, except diamond:			
Natural	value	$442,419	$442,543
Manufactured	do	$9,544	$24
Pyrite		18	53
Salt and brines		115,883	142,157
Sodium and potassium compounds, n.e.s.:			
Caustic soda		10,773	5,015
Caustic potash, sodic and potassic peroxides, natron		22,062	28,536
Stone, sand and gravel:			
Dimension stone, crude and worked		3,239	2,171
Dolomite, chiefly refractory grade		33	2,089
Gravel and crushed rock		2,845	6,845
Limestone (except dimension)		1,229	891
Quartz and quartzite		33	11
Sand, excluding metal bearing		1,695	1,508
Sulfur:			
Elemental		14,933	28,635
Sulfur dioxide		16	7
Sulfuric acid		2,621	1,716
Talc, steatite, soapstone, pyrophyllite		4,798	6,028
Other:			
Crude		32,970	41,919
Slag, dross, and similar waste, not metal bearing		402	1,071
Oxides and hydroxides of magnesium, barium, strontium		492	142
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		2,158	4,308
Carbon black		10,410	6,181
Coal and briquets:			
Anthracite and bituminous coal and briquets		22,514	20,284
Lignite and lignite briquets		12	1,004
Coke and semicoke		14,843	27,024
Hydrogen, helium, rare gases	value	$54,116	$47,607
Peat		80	8
Petroleum:			
Crude	thousand 42-gallon barrels	23,514	27,204
Partly refined	do	4,323	1,708

See footnotes at end of table.

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Table 3.—Malaysia: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity		1976	1977
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum —Continued			
Refinery products:			
Gasoline	thousand 42-gallon barrels	1,152	[illegible]
Jet fuel	do	35	11
Kerosine	do	359	717
Distillate fuel oil	do	3,534	[illegible]
Residual fuel oil	do	2,815	[illegible]
Lubricants	do	725	[illegible]
Other:			
White spirits	do	35	[illegible]
Mineral jelly and wax	do	50	[illegible]
Nonlubricating oil	do	29	[illegible]
Petroleum coke	do	1	[illegible]
Bitumen and other residues	do	144	131
Liquefied petroleum gas[3]	value, thousands	$3,349	[illegible]
Unspecified	thousand 42-gallon barrels	186	[illegible]
Total[3]	do	9,364	[illegible]
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		3,161	[illegible]

[r] Revised.

[1] Includes intrastate trade.

[2] Less than 1/2 unit.

[3] Total excludes liquefied petroleum gas.

COMMODITY REVIEW

METALS

Aluminum.—Bauxite was produced by the Telok Ramunia Mine in Johore State, operated by Southeast Asia Bauxite Sdn. Bhd., a subsidiary of Alcan. Annual mine output has decreased from the 1-million-ton level of the 1969-73 period to about two-thirds this level in 1978. Mine production has been diminishing annually owing to lower grade ore. Ore reserves at Telok Ramunia were estimated at about 10 million tons. Because Malaysia lacks both alumina and smelter facilities, its bauxite production was exported; as in previous years, the bauxite output was exported to Japan.

The Sabah and Sarawak State governments have been encouraging the construction of smelter facilities at Labuan Island and Bentulu, respectively. Because of increased oil production, up to 80% of the associated natural gas from Malaysia's offshore oilfields was flared rather than utilized. The proposed smelter at Labuan would use natural gas for generating electrical energy, and natural gas from the Bentulu field might be used initially for an aluminum smelter in Sarawak.

Copper.—Overseas Mineral Resources Development Sabah Bhd. produced copper concentrate grading 28% copper from the Mamut porphyry copper mine in Sabah, on the northern end of Borneo Island. This concentrate is shipped to Japan for smelting and refining. The ore mineral at Mamut is composed primarily of chalcopyrite with molybdenite, galena, and sphalerite. Copper mineralization occurs in the potash-rich adamellite porphyry intrusion as well as in the wall rock (serpentinite and clastic sedimentary rocks). Mamut has an estimated ore reserve of 179 million tons of 0.476% copper and about 0.5 grams per ton of gold.

Iron Ore.—Annual mine production of iron ore has declined to about 300,000 tons in recent years. Iron ore was mined from relatively small deposits by eight operations in Panang, Johore, Perak, and Kedah States, all of which are in Peninsular Malaysia. Production in Panang accounted for about one-half the total output. Although deposits of high-grade ore are known to exist in Malaysia, none contain sufficient reserves to support profitable mining.

Tin.—Malaysia continued to be by far the largest world producer of mine tin and tin metal in 1978 and 1979. Of the 1978 mine tin output, 54% was from gravel pumping operations; 32% was from dredging; 5% was from open casting; 2% was from underground mines; and the remainder was from various small operations. During 1978, there was a total of 936 active mining operations, comprised as follows: gravel pumps, 833; dredges, 53; open cast, 22; and others, 28. Workers employed by Malaysia's gravel pumping operations made up 66% of the world tin industry's total labor force.

Employment by other types of tin-producing operations was as follows: dredging, 8,700 persons; open casting, 1,500 persons; underground mines, 1,900 persons; and others, 1,600 persons.

Despite high prices (M$1,822 per picul at the beginning of 1979, compared with the average price of $1,743.19 per picul during 1978), total tin production continued to show an overall downward trend. Aside from production in 1977, the output in 1978 was the lowest since 1965.

To encourage new production, the tin industry petitioned the Government to revise the tax policies that applied to tin mining. It was estimated that the Government received up to 80% of the mining companies' profits through taxes. Affecting the industry were direct taxes, including export duties and taxes on tin profits, income, and development; and indirect taxes such as sales tax, import duties, and a surcharge on imports.

Because of increased profitability, tin stealing and smuggling has increased since 1977. In 1978, 3,247 piculs of tin ore valued at $5.5 million was seized from smugglers, compared with 2,626 piculs worth $3 million in 1977. The value of export duty payable on the ore seized in 1978 was estimated at $1.1 million. The Government was expected to review and evaluate the Tin Control Regulations of 1977 in light of the increase in tin theft and smuggling.

Land alienation, conversion, and renewal is a State matter. However, export duty is paid to the Federal Government, and the State receives only a small percentage of the duty along with annual land fees. As a result of this arrangement, the States have been reluctant to allocate land for mining ventures. A committee of representatives of the Federal and State Governments was reviewing the draft of a National Mining Code to streamline procedures governing prospecting, the issuing and renewal of leases, and the conversion of mining land.

Malaysia Mining Corp. (MMC), formerly London Tin Group, accounts for about 30% of the country's tin concentrate output and is one of the world's leading tin producers. MMC, which is owned 71.35% by Pernas Securities and 28.65% by Charter Consolidated, has individual holdings in 13 Malaysian tin mining companies. Pernas Charter Management, general manager of all of MMC's companies, including two in Thailand, operated 35 dredges in Malaysia. MMC arranged to sell tin directly to consumers, after smelting on a toll basis, rather than to the Penang Tin Market. Also, MMC was preparing to establish a Commodities Exchange in Kuala Lumpur, was possibly interested in becoming directly involved with smelting, and was actively negotiating joint ventures in various States with established mining companies.

Companies operating tin-producing dredges were as follows: Ayer Hitam, three dredges at its mining leases south of Selangor; Berjuntai, seven dredges in Kuala Selangor; Kamunting, two dredges near Taiping; Malayan Tin, five dredges near Kampong Gajah in Perak; Southern Kinta, two dredges in Bernam, Selangor, and one in southern Kanipar in Kinta Valley; Southern Malayan, six dredges in Tanjong Tualang in Kinta Valley and Batang Padang, Perak; Tronoh Mines, two dredges in Ayer Kuning, Perak; Bidor Malaya Tin (51% owned by Tronoh Mines), four dredges in Bidor, Perak; Penghalen, one dredge in Kinta Valley in Perak; Petaling Tin, two dredges in southwest Selangor; and Tanjon Tin, one dredge in Kinta Valley in Perak. Kinta Kellas also operated a dredge and an open-cast mine in Kinta Valley. Goping has open-cast, hydraulic, and gravel pumping operations in Ipoh, Perak; and Idris Hydraulic uses gravel pumping hydraulic operations in Ipoh. Pahang Consolidated operates the only underground lode mine in the country on the east coast of Peninsular Malaysia. As of July 31, 1978, ore reserves at this mine were estimated at 500,000 tons at an average grade of 1.3% tin.[8]

Titanium.—Ilmenite, an iron-titanium oxide, is a major mineral obtained as a byproduct of alluvial tin mining. Malaysian ilmenite assays about 53% TiO_2, but higher grades (up to 65% TiO_2) have been recovered at Sungkai, Perak and Petaling, Selangor. Exports of ilmenite, all from West Malaysia, totaled about 187,000 tons in 1978.

Other Metals.—Other minerals recovered from tailings of dredging operations included columbite, scheelite, zircon, and the rare-earth minerals, monazite and xenotime. In addition to small quantities of wolframite concentrate recovered as a byproduct of alluvial tin operations, the major source of tungsten production in Malaysia was a wolframite lode in Panang. Gold was recovered as a byproduct of tin dredging operations at Batang Padang and Kuala Lumpur, and from small-scale mining operations in the Raub area and the Bau District in Sarawak. During 1978, 11 operations were mining gold; 7 were in Sarawak, and 4 were in Peninsular Malaysia.

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NONMETALS

Cement.—Cement production in 1978 increased by about 24% over the 1977 level of production. Malaysia's largest cement producer was Tasik Cement Bhd. in Ipoh, which has an annual output capacity of 1.04 million tons. Other cement producers were as follows, with capacity expressed in thousand tons per year: Associated Pan Malaysia Cement Sd. Berhad, 900; Cement Industries of Malaysia Sd. Berhad, 400; and Malaysia Industrial and Mining Corp. Berhad, 60.

Fertilizer Materials.—Domestic production of nitrogenous phosphatic and potassic fertilizers totaled about 327,000 tons, and 20 companies contributed to the total. Three of these companies accounted for about 35% of the total output. In order to meet the domestic demand for fertilizers, an equivalent quantity of fertilizers was imported in 1978; imports consisted mainly of potassic fertilizers, urea, and composite, complex, and compound fertilizers. The major suppliers of fertilizer materials were the Christmas Islands, Canada, the Federal Republic of Germany, Japan, and the United States.

Other Nonmetals.—Crushed rock was produced primarily in Selangor, Johore, Panang, and Perak. Crushed granite, most of which was used for road metal and concrete aggregate, accounted for 68% of total production. The remainder was predominantly limestone, of which about 50% was used for road metal and concrete aggregate, 40% was used for cement manufacture, and 10% used for for various specialty applications. Almost all of the output of sand and gravel was used as concrete aggregate; and Perak, Tohore, Penang, and Pahang were the major producing States.

Kaolin production remained at 32,000 tons per year. Mine output came from 13 operations, all in Peninsular Malaysia. Part of the output was consumed locally by the ceramic, paint, rubber, plastics, and pesticide industries; the remainder was exported to Japan and Singapore. Domestic ball clay, obtained mostly from alluvial tin mining operations, was used with kaolin for manufacturing wall, floor, mosaic tiles, sanitaryware and tableware. Common clay mined locally was used primarily for drainage and sewer pipes, flower pots, and similar uses.

Output of quartz sands and powder was primarily from sand deposits in Johore and from tin tailings operations. Most of the quartz was used locally by the glass and ceramics industries, and some was exported. Barite production was wholly from the Tasek Chini deposit in Pahang.

MINERAL FUELS

Petroleum and Natural Gas.—At the beginning of 1979, Malaysia's proven reserves of oil were estimated at 2.8 billion barrels.[6] Oil production by 3 companies in 1978 averaged 196,500 barrels per day and was from 154 producing flow wells. Output by Esso Malaysia from the Pulai, Tapis, and Tembungo fields averaged 32,700 barrels per day; Sarawak Shell produced 94,100 barrels per day from the Bakau, Baram, Baronia, Fairley-Baran, Tukan and West Lutong fields; and Sabah Shell produced 69,700 barrels per day from the Samarang field. The largest producing fields to date have been Baram, discovered in 1973 (cumulative production of 91.2 million barrels); followed by West Lutong (84.6 million barrels since 1966); Miri (79.7 million barrels since 1911, but now shut in); Baronia (59.9 million barrels since 1967); and Samarang (54.6 million barrels since 1972).

Because of disputes involving estimated reserves and projected development costs, Conoco withdrew from its concession in Sotong, and its acreage was relinquished to Petronas Carigali, the exploration-drilling arm of Petronas, the national oil company. Carigali was expected to begin drilling in 1980, individually or with a partner, on the old Conoco concession. Seven wells were planned, three for appraisal and four for exploration.

Natural gas reserves in Malaysia was estimated at 17 trillion cubic feet as of January 1, 1979. Presently, all natural gas output is associated with oil production. Only about 20% is captured, and the remainder is flared. However, Shell was developing gas reserves to feed a $1 billion liquefied natural gas (LNG) project in Sarawak. Beginning in 1983, 850 million cubic feet per day of LNG is to be exported to Japan.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Malaysian dollars (M$) to U.S. dollars at the rate of M$2.20 = US$1.00.

[3] Bank Negara Malaysia. Quarterly Economic Bull., V. 12, No. 3, September 1979, 158 pp.

[4] Far Eastern Economic Review Ltd. Asia 1980 Yearbook. Hong Kong. 1980, 320 pp.

[5] Mining Annual Review-1979, London. pp. 450-455.

[6] The Petroleum Publishing Co. International Petroleum Encyclopedia. Tulsa, Okla., 1980, 407 pp.

The Mineral Industry of Malta

By Roman V. Sondermayer[1]

During 1978-79, Malta produced only limestone and salt. Modest demand for fuels, lime, cement, fertilizers, diamonds, and metals was met through imports.

The major event related to minerals was the organization of Enemalta Corp., which was established by an Act of Parliament-Act XVI of 1978. Enemalta took over responsibilities of the Electricity Board and the Gas Board of Malta. The new organization is in charge of all energy-related activities in Malta including production of electricity and distillation of sea water. In 1979, the possibility of building a petroleum refinery on Malta was examined together with the Government of Libya, which showed interest in financing the project. However, at yearend 1979, no agreements on the refinery project were announced.

PRODUCTION

Table 1 shows the latest trends in production of minerals in Malta. The industry was mostly made up of small family-run enterprises.

Table 1.—Malta: Production of mineral commodities

Commodity and unit of measure	1976	1977	1978[p]	1979[e]
Lime thousand metric tons	27	32	28	30
Limestone[e] [1] thousand cubic meters	962	802	850	900
Salt metric tons	290	797	600	500

[e]Estimate. [p]Preliminary.

[1]Figures represent reported production plus an estimate for quantitatively unreported output.

TRADE

Malta depended on imports of a number of mineral commodities but all in small quantities.

Fuels were major import and export items; bunkering was the principal category of exports. Foreign mineral trade is shown in table 2.

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[1]Physical scientist, Branch of Foreign Data.

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Table 2.—Malta: Value of trade in mineral commodities

(Thousand dollars)

Commodity	1977		1978	
	Exports and reexports	Imports	Exports and reexports	Imports
Oxides and hydroxides	--	342	--	427
Metals, including scrap:				
Iron and steel	823	14,474	1,755	15,711
Nonferrous	786	9,813	1,398	13,766
Cement	--	4,992	13,008	5,652
Fertilizer materials	--	406	--	564
Crude petroleum and refinery products	16,084	38,533,523	12,504	38,792,761
Other	1,479	7,585	2,416	9,656

The Mineral Industry of Mauritania

By Candice Stevens[1]

The production and export of iron ore, Mauritania's main export commodity, rebounded in 1979 after falling to low levels in 1978. The rise of the Mauritanian economy began with the start of iron ore production in 1963, and the decrease in iron ore production in 1978 caused an overall economic decline. Adverse world market conditions, depletion of the older deposits, and local conflict prompted the decrease in iron ore output and reduced the contribution of the mineral sector to 21% of the gross domestic product (GDP) of $515 million.[2] For similar reasons, the copper operation at Akjoujt closed down in 1978. In that year, Mauritania suffered a large balance of trade deficit, a balance of payments deficit of $80 million, and a total foreign debt burden of $750 million.

The country's primary development projects were the exploitation of low-grade iron ore reserves, the construction of a deepwater port at Nouakchott, and the completion of the Nouakchott-Nema road. In an effort to stabilize the economy, the Government enacted measures to reduce imports by 20%, reschedule foreign debts, cut Government expenditures through an austerity budget, and revive the private sector. A new investment code adopted in 1976 included economic incentives for private enterprise such as tax exemptions, guarantees against nationalization, and provisions for private repatriation. In 1978, Mauritania received a loan of $13.7 million from the International Monetary Fund (IMF) to help offset the drop in the country's export earnings.

The Société Nationale Industrielle et Minière (SNIM) was the Government's holding company in charge of most mining operations. In 1978, the Government offered for sale 49% of the stock in SNIM to obtain financing for the iron ore project. At yearend 1979, new shareholders included the Arab Mining Co., the Islamic Development Bank, Morocco, Kuwait, Iraq, and Libya. SNIM was also relieved of its operating responsibilities for the Nouadhibou petroleum refinery and the Akjoujt copper mine in the attempt to solidify its economic foundation. SNIM registered a loss of $16 million in 1978 but reported an improved financial situation in 1979.

PRODUCTION AND TRADE

The production of Mauritania's major mineral commodity, iron ore, declined greatly in 1978 owing primarily to disruptions in the supply route and low world prices, but normal production levels were reinstated in 1979. Less than 3,000 tons of copper was produced in 1978 and the mine was closed in midyear. Gypsum production evidenced an increasing trend as operations were expanded.

Mauritania's balance of trade deficit increased to $176 million in 1978 when mineral exports were at low levels. Mineral exports typically account for about 73% of total export value. Iron ore exports fell to 6.5 million tons in 1978 but increased to about 9 million tons in 1979. In 1978, iron was exported to France (34%), Italy (22%), other Western European countries, and Japan. In 1979, Mauritania concluded an

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agreement with Japan to export 1.4 million tons of iron ore during the year. All copper production was exported primarily to France and Spain. Gypsum production was exported to Senegal. In 1978, Mauritania imported about 3,000 tons of fertilizer, 52,000 tons of cement, and 200,000 tons of refined petroleum products.

Table 1.—Mauritania: Production of mineral commodities

Commodity[1] and unit of measure	1976	1977	1978[p]	1979[e]
Copper, mine output, metal content metric tons	9,431	7,640	1,773	--
Gold troy ounces	22,120	28,000	8,000	--
Gypsum metric tons	11,195	10,176	13,438	13,600
Iron ore and concentrate, gross weight thousand metric tons	9,644	9,794	6,934	8,000
Rare-earth metals: Monazite concentrate, gross weight[e] metric tons	100	100	100	100
Salt, marine[e] do	1,000	1,000	1,000	1,000
Silver troy ounces	31,572	[e]26,000	19,000	--

[e] Estimate. [p] Preliminary.

[1] In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (clays, stone, and sand and gravel) presumably are produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

COMMODITY REVIEW

METALS

Copper.—Mining at the Akjoujt copper deposit ceased in May 1978 owing to financial losses caused by low copper prices and technical difficulties at the mine. Losses in 1977 were reported at $13 million. Reserves of copper oxide ore were almost depleted. Exploitation of copper sulfide reserves was postponed owing to the financial difficulties of SNIM. Reserves of copper sulfide ore were estimated at 14 million tons averaging 2.3% copper. Original plans called for mining 120,000 tons of sulfide ore per year and the construction of a new flotation plant. Plans for the construction of a copper smelter at Nouakchott were also canceled.

Iron Ore.—In 1978, iron ore production fell to its lowest level since the nationalization of the industry in 1974. With the resolution of the local conflict situation and an increase in world prices, output increased in 1979. Exploitation of the iron ore deposits in the Kedia d'Idjil range near the city of Zouerate was under the direction of the Complexe Minier du Nord (COMINOR), a division of SNIM. The older mines, Tazadit, Rouessa, and F'Derick, had an annual production capacity of 11.4 million tons per year. Reserves were expected to be depleted by 1985.

Mauritania's major development project was the exploitation of low-grade iron orebodies known as the Guelb deposits. More than 25 Guelb deposits, containing magnetite ore with a content of 38% iron, were within a radius of 50 kilometers of Zouerate. Exploration was focused on the deposits of El Rhein and Oum Arwagen, with combined reserves of 400 million tons. A pilot plant was erected at Zouerate in 1974 that produced magnetic and oxidized sinter feed with 64% to 66% iron through autogenous grinding and dry magnetic separation. A feasibility report prepared by Société de Cooperation Minière et Industrielle (Socomine) (France) in 1975 scheduled the startup of the El Rhein deposit and the first section of a benefication plant in 1981. The startup of the Oum Arwagen deposit and the second stage of the plant was to follow in 1988. Annual production capacity was to be initially 6 million tons rising eventually to 12 million tons. Production was to be transported and shipped by way of the existing 650-kilometer rail link to the port of Nouadhibou. Socomine, which was awarded a contract for supervision of the Guelbs project, issued tenders for the supply of equipment for mining, materials handling, and civil engineering in 1978.

Almost all financing was secured for the first stage of the project estimated to cost $500 million. SNIM was to contribute $43 million. The remainder would be financed by an international consortium of donors led by the International Bank for Reconstruction and Development (IBRD) ($60 million), Saudi Arabia ($60 million), and Kuwait ($40 million).

A ministeelworks began production in Nouadhibou in March 1979. Capacity of the steelworks was 12,000 tons per year of raw steel and 36,000 tons per year of rolled steel. Studies were in progress by Kobe Steel Ltd. (Japan) on the construction of an iron ore pelletizing plant at Nouadhibou. The $130 million plant was to be operated by Société Arabe d'Industries Metallurgiques (SAMIA), a joint venture of Mauritania and Kuwait.

Uranium.—The uranium exploration program in the northern Tasiast and Dorsale Reguibat regions was suspended in 1978 owing to conflict in the area but the program resumed at yearend 1979. Prospecting has been carried out since 1975 by Compagnie Francaise des Petroles (CFP) in conjunction with Pechiney Ugine Kuhlman, the Commissariat à l'Energie Atomique (France), and the Tokyo Uranium Development Co.

NONMETALS

Gypsum.—Production of gypsum increased at Sebkha de N'Drahamcha, located 65 kilometers north of Nouakchott. Gypsum was contained in high-grade, fine-particled sand grading 94% $CaSO_4$ and less than 0.3% NaCl. Output was exported to Senegal for use in the Société Quest-Africaine des Ciments (SOCOCIM) plant at Rufisque. SNIM hoped to diversify the gypsum export market upon the completion of the new deepwater port at Nouakchott.

As part of an $8 million credit received from the International Development Association (IDA), consulting services were to be provided to study the feasibility of establishing a gypsum plaster brick industry. The construction of a plaster works was to alleviate Mauritania's dependence on imported cement with locally made brick. It was also reported that SNIM was conducting a feasibility study of a 150,000-ton-per-year cement plant.

Salt.—Studies were being conducted by the Compagnie pour Etudes Techniques et Economiques (COMETE) (France) for the exploitation of the Sebkha N'Drahamcha salt deposits. The deposits were estimated to contain 11 million tons of salt. Annual production capacity was expected to be 30,000 tons per year.

MINERAL FUELS

Petroleum.—Approximately 100,000 tons of petroleum was refined at the Nouadhibou refinery, completed in June 1978. After this test run, the refinery was closed owing to crude oil supply problems and the necessity of instituting technical modifications to meet safety requirements. Constructed by Voest Alpine (Austria), annual production capacity of the refinery was 1 million tons per year. Output was originally to supply domestic requirements (300,000 tons per year) with the balance destined for European markets. Negotiations were being conducted with Algeria in 1979 for technical assistance in making the refinery operational.

Exploratory drilling for petroleum was to be undertaken by the Seagap Group, a consortium including Hispanoil, Phillips Petroleum Co., and Shell Oil Co. The group held a 24,000-square-kilometer concession including both onshore and offshore areas near Nouadhibou. Elf-Acquitaine (France) acquired a concession area offshore Nouakchott in 1979 and was to commence exploration in 1980.

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[1] Economist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Mauritanian ouguiya (UM) to U.S. dollars at the rate of UM45.13 = US$1.00.

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[illegible]

The Mineral Industry of Mexico

By Doris M. Hyde[1]

Mexico's economy has shown significant growth. The 1978 gross domestic product (GDP), at constant 1960 prices, was $92.4 billion,[2] an increase of 7% over 1977. In 1979, the GDP was estimated at $120 billion and represented the highest growth rate in 10 years. Growth was stimulated by increased private and public investment and increased consumption. Higher inflation accompanied Mexico's economic growth—rising 17.5% in 1978 and 18.2% in 1979.

There has been a sharp increase in the demand for goods and services and, consequently, import levels increased dramatically. In 1979 the total value of imports was more than double that for 1977. The total export value also doubled in this 2-year period; but in spite of an almost quadrupling of crude oil export value, the trade deficit grew from about $1.5 billion in 1977 to $3.2 billion in 1979.

Mexico's mining industry produces 18 metallic and 28 nonmetallic minerals. Ten of these, copper, coke, fluorspar, gold, iron, lead, manganese, silver, sulfur, and zinc, represent about 93% of the value of total mineral production. In 1979 mineral production accounted for 1.3% of the GDP, compared with 1.1% in 1978. Investments in the mineral sector under the "Alliance for Production" have reached approximately $1.28 billion and in 1980 an investment of about $775 million is expected.

An inadequate railroad transport system and insufficient port capacities adversely affected both internal and external movement of material in the petroleum and the mineral industries. Mining companies found it necessary to move concentrates by more costly and slower truck transport. Additional railroad equipment came into service by the end of 1979 as part of a modernization program promised in 1978. The Government has also initiated measures to upgrade port facilities.

Government Policies and Programs.—The new mining taxation and subsidy law, which became effective January 1, 1978, combined the previous production and export taxes into a simplified production tax based on the mineral content of the ore or concentrate. The tax varies with the mineral produced: 9% on the official value of gold, silver, and sulfur; 4% on coal, iron ore, and manganese; and 7% on all other minerals. A 2% per annum reduction or subsidy of the value of minerals produced is allowed if the money is reinvested in exploration or mineral development during the same calendar year. An additional reduction of 1% is allowed to small producers whose annual gross mineral sales are less than $1 million. A 75% subsidy of the general import taxes on machinery, equipment, parts, and replacements, was granted to mining concerns that import these items when they are not manufactured in Mexico. This latter subsidy requires prior approval of the Finance and Public Credit Secretariat. Concession taxes were set at $1.33 per hectare for nonmetallic minerals and $2.65 per hectare for metallic minerals. The exploration tax was set at $0.44 per hectare per year.

The mining industry has benefited from the new mining tax law, and it was reported that additional changes are under consideration to further simplify mining operation and investment.

In November 1978, the Consejo de Recursos Minerales joined with the United Nations Institute for Training and Research to hold the First International Conference on Small-Scale Mining of the World. Nearly 70

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countries were represented at the meeting in Mexico. A small-scale mining company, by Mexican law, is one which produces a gross income under $880,000 annually. These small operations are considered important from the employment aspect since they are less capital intensive and cover a wide geographic area. In many instances they have provided the preliminary work for what eventually became large operations.

Late in 1978 the Government placed the entire nuclear industry under a single agency, the Comisión Nacional de Energía Atómica (CNEA). CNEA will have the ultimate responsibility over research, production, and marketing. Under CNEA's control are the Instituto Nacional de Investigación Nuclear (ININ), the research division; and Uranio de Mexico (Uramex), the division responsible for supervising exploration and exploitation. The bill that established CNEA also stipulated that no uranium could be exported until a 15-year nuclear energy program for Mexico had been submitted and approved.

PRODUCTION

In 1978, Mexico easily maintained its position as the world's leading producer of silver. Contrary to expectations and despite price incentives, silver production fell in 1979. Gold output also declined in 1979. The production declines were attributed to lower grade ores and not to inactivity at major installations. Decreased 1979 production of manganese was offset by increases in dollar values.

The mid-1979 opening of the La Caridad copper mine was reflected in the substantial increase in 1979 copper production over that of 1978. As the mine progresses toward full development, copper production in 1980 is expected to more than double that of 1979.

Mexican mercury producers were not able to take full advantage of an improved mercury market in 1978-79 due to the disorganization resulting from operators working small scattered deposits. These deposits have a limited productive life and present little opportunity to adjust production to demand. Many operations had ceased when the mercury market fell to unprofitable levels in 1976.

Petroleum production gains were impressive in 1978-79, but fell somewhat short of earlier predictions. Crude oil production from the Northern Zone during 1978 increased over that of 1977; but in 1979, production fell below the 1977 level. This same production pattern was true for the Central Zone. It was in the Southern Zone that large production increases were sustained in 1978-79, especially in the Comalcalco, El Plan, and Gulf of Campeche areas. Natural gas production increased in all three zones during 1978-79, with the Southern Zone predominating. Natural gas flaring was reduced to 6% in 1979. As new gas-processing plants and pipelines come onstream, flaring is expected to drop to about 3% of production in 1980.

Table 1.—Mexico: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum metal, primary	42,358	42,720	43,092	[2]43,196
Antimony:[3]				
Mine output, metal content	2,546	2,698	2,457	2,400
Metal (in mixed bars)	593	934	490	500
Arsenic, white[4]	5,499	5,744	6,245	6,400
Bismuth[5]	557	729	978	[2]400
Cadmium:				
Mine output, metal content	1,844	1,781	1,894	1,700
Metal, refined	710	908	897	900
Copper:				
Mine output, metal content	88,970	89,662	87,186	90,000
Metal:				
Blister	85,175	87,457	86,978	[2]98,000
Refined	75,418	73,062	74,990	90,000
Gold:				
Mine output, metal content troy ounces	162,811	212,709	202,003	[2]188,000
Metal, refined do	150,722	196,634	190,718	170,000

See footnotes at end of table.

Table 1.—Mexico: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS —Continued				
Iron and steel:				
Iron ore:				
Gross weight[6] thousand tons	5,466	5,381	5,384	6,600
Metal content do.	3,644	3,587	3,556	4,060
Metal:				
Pig iron and sponge iron do.	3,528	4,329	5,137	3,400
Ferroalloys do.	93	152	171	185
Crude steel do.	5,298	5,601	6,775	7,000
Semimanufactures do.	4,140	4,302	5,255	5,500
Lead:				
Mine output, metal content	200,027	163,479	170,593	180,000
Metal, smelter (in refined and mixed bars)	189,731	153,948	166,098	160,000
Manganese ore:				
Gross weight[7]	453,211	486,623	523,167	544,000
Metal content	163,156	175,184	188,340	195,800
Mercury, mine output, metal content 76-pound flasks	15,026	9,660	2,205	2,000
Molybdenum, mine output, metal content	16	1	11	23
Nickel, mine output, metal content	56	34	22	20
Selenium, elemental	58	50	80	82
Silver:				
Mine output, metal content thousand troy ounces	42,640	47,030	50,779	[3]49,310
Metallurgical products, metal content do.	40,215	43,913	48,903	56,500
Tin:				
Mine output, metal content	481	220	73	100
Metal, smelter, primary[e]	800	1,000	1,000	1,000
Tungsten, mine output, metal content	[r]188	151	185	200
Zinc:				
Mine output, metal content	259,183	265,469	244,892	225,000
Metal, smelter, primary	175,210	174,376	178,094	160,000
NONMETALS				
Asbestos	1	--	--	--
Barite	270,063	270,674	231,485	272,000
Cement, hydraulic thousand tons	12,584	13,227	14,056	[3]15,050
Clays:				
Bentonite	55,583	59,169	33,795	36,200
Fuller's earth	20,108	61,369	39,958	40,800
Kaolin	71,350	178,211	179,500	180,000
Common	111,362	70,313	67,985	NA
Diatomite	26,294	23,574	22,452	22,700
Feldspar	73,239	114,319	127,554	127,000
Fluorspar, all grades thousand tons	1,004	955	960	962
Graphite, all grades	60,337	58,482	52,264	49,800
Gypsum and anhydrite, crude	1,414,237	1,495,750	1,757,858	1,900,000
Magnesite	23,186	66,400	76,035	76,000
Mica, all grades	1,308	771	401	408
Nitrogen, N content of ammonia	715,729	780,321	1,303,914	1,360,000
Perlite	14,555	22,429	24,517	25,000
Phosphate rock	224,428	285,470	322,076	350,000
Salt, all types thousand tons	4,591	4,900	5,635	5,600
Sodium compounds:				
Soda ash (sodium carbonate) do.	390	[e]420	414	420
Sodium sulfates, natural	228,025	109,489	127,710	131,500
Stone, sand and gravel:				
Calcite, common	4,902	8,784	19,753	15,000
Dolomite	347,007	433,429	249,245	250,000
Limestone[9] thousand tons	4,763	4,750	1,481	1,500
Marble	2,449	1,348	1,269	1,200
Quartz, quartzite, glass	509,029	626,715	532,209	500,000
Strontium minerals	22,157	45,633	33,169	33,000
Sulfur, elemental:				
Frasch process thousand tons	2,054	1,723	1,818	1,960
Byproduct:				
Of metallurgy[e] do.	75	[r]80	100	100
Of natural gas do.	96	183	135	330
Total do.	2,225	1,986	2,053	2,390
Talc	192	168	2,639	2,700
Wollastonite	1,143	692	5,653	5,000
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	171,108	109,728	207,467	210,000
Coal, bituminous thousand tons	5,650	6,610	6,756	6,800

See footnotes at end of table.

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Table 1.—Mexico: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]		1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Coke:					
Metallurgical	thousand tons	2,151	2,815	2,808	2,800
Imperial	do	21	12	11	11
Breeze	do	16	65	87	90
Total	do	2,188	2,892	2,906	2,901
Gas, natural:					
Gross	million cubic feet	771,774	746,863	934,911	[2]1,064,559
Marketable	do	[r]577,926	600,051	744,891	[2]914,873
Natural gas liquids:					
Field condensate	thousand 42-gallon barrels	[e]95	105	1,259	[2]3,897
Other	do	34,154	38,136	42,689	[2]52,644
Petroleum:					
Crude	do	267,320	357,985	441,348	[2]533,329
Refinery products:					
Gasoline:					
Aviation	do	565	525	585	[2]638
Other	do	76,366	83,492	88,643	[2]102,599
Jet fuel	do	6,179	7,749	7,390	[2]9,164
Kerosine	do	13,444	12,416	13,840	[2]14,696
Distillate fuel oil	do	59,075	66,574	72,461	[2]78,584
Residual fuel oil	do	78,217	85,122	88,963	[2]96,084
Lubricants	do	3,103	2,823	2,931	[2]2,836
Other:					
Liquefied petroleum gas	do	20,278	24,030	27,024	[2]32,068
Asphalt	do	3,690	4,403	4,819	[2]5,390
Unspecified	do	[r]4,716	6,135	6,138	[2]7,090
Refinery fuel and losses	do	11,405	15,460	13,834	[2]16,647
Total	do	[r]277,038	308,729	326,628	[2]358,287

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[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities listed, lime, pumice, and additional types of crude construction materials are produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

[3] Sb content of ores for export plus Sb content of antimonial lead and other smelter products produced.

[4] Calculated white As equivalent of metallic As content of products reported.

[5] Bi content of refined metal, bullion, and alloys produced indigenously, plus recoverable Bi content of ores and concentrates exported for processing.

[6] Calculated from reported Fe content on the basis of ore containing 66.67% iron.

[7] Calculated from reported Mn content of mine production on the basis of ore containing 36% manganese.

[8] Estimates by the International Tin Council.

[9] Excluding that for cement production.

TRADE

Petroleum continued to dominate Mexico's export trade. In 1978 petroleum exports contributed about 30% to the $6.2 billion value of total exports, and in 1979 it accounted for an estimated 45% of the $8.9 billion total value. About 96% of all petroleum exports consisted of crude oil. The United States has remained the major importer of Mexican oil. Throughout 1978-79 Mexico continued to diversify its future petroleum export market, successfully using oil as a means of obtaining favorable technological and industrialization cooperative agreements.

After almost 2 years of price negotiations, Mexico agreed to sell 300 million cubic feet per day of natural gas to the United States with export to begin in January 1980. The price, $3.625 per thousand cubic feet, represented a substantial boost to the Mexican export economy as it is tied to world petroleum prices and subject to a quarterly review.

In 1978 the value of nonfuel mineral exports was about $510 million. Exports to the United States accounted for 60% of this value. In 1979 nonfuel mineral export value increased to $789 million. Silver, zinc, lead, sulfur, and fluorspar minerals remained the leading mineral exports in 1978, representing 48% of total value. Despite decreased silver export volumes, its steadily rising price during 1979 was the major reason for the increase in the overall nonfuel mineral export value for that year.

Imports of nonfuel minerals in 1978 reached $417 million, a 68% increase over the 1977 value. Increased imports of aluminum, iron, and copper accounted for about 85% of the value difference. In 1979 Mexico's mineral import costs increased to an estimated $513 million.

Table 2.—Mexico: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum metal including alloys, all forms	51	(1)	All to United States.
Antimony:			
Ore and concentrate	3,387	4,871	United States 3,104; United Kingdom 1,767.
Metal including alloys, all forms	143	384	Brazil 191; United States 160; Netherlands 31.
Arsenic trioxide, gross weight	3,244	2,802	United States 2,364; Brazil 417; Australia 15.
Bismuth metal including alloys, all forms	331	187	Belgium-Luxembourg 145; United States 40; Netherlands 1.
Cadmium:			
Intermediate metallurgical products	3	--	
Metal including alloys, all forms	961	759	United States 597; United Kingdom 55; Netherlands 28.
Chromium: Chromite	--	4	All to Costa Rica.
Cobalt, intermediate metallurgical products	--	8	All to United States.
Copper:			
Ore and concentrate	995	569	Do.
Copper sulfate	420	1,011	Brazil 632; United States 294; Honduras 33; Japan 25.
Metal including alloys, all forms	12,885	960	Japan 897; United States 56; Peru 5.
Iron and steel:			
Ore and concentrate	802	1,015	Guatemala 545; United States 400; West Germany 70.
Metal:			
Scrap	1,745	315	United States 281; France 34.
Pig iron and similar materials	150	43	All to United States.
Sponge iron, powder, shot	192	7,127	Japan 6,547; United States 294; Venezuela 186.
Ferroalloys	26,619	3,331	NA.
Steel, primary forms	2,985	1,152	Mainly to United States.
Semimanufactures	15,786	14,119	United States 13,656; Venezuela 250; Guatemala 64.
Lead:			
Ore and concentrate	9,965	11,108	All to United States.
Oxides	34,692	37,470	United States 21,513; Venezuela 6,993; Colombia 1,650.
Metal including alloys:			
Scrap	137	44	All to United States.
Unwrought	77,574	75,438	United States 41,702; Italy 14,126; Japan 8,763.
Semimanufactures	574	330	United Kingdom 167; West Germany 78; Canada 28.
Manganese ore and concentrate	257,213	198,509	Japan 76,959; France 55,016; United States 30,613.
Mercury ... 76-pound flasks	13,870	6,278	Brazil 2,804; United States 2,790; Argentina 303.
Molybdenum metal including alloys, all forms kilograms	91	--	
Nickel metal including alloys, all forms do.	1,485	2,380	Guatemala 2,282; Nicaragua 98.
Selenium, elemental	52	30	United Kingdom 14; United States 10; Brazil 6.
Silver:			
Ore and concentrate thousand troy ounces	942,504	941,539	All to United States.
Metal including alloys, all forms do.	23,126	26,472	United States 14,893; United Kingdom 5,484; Belgium-Luxembourg 3,071.
Tin:			
Ore and concentrate	--	61	United States 60; Peru 1.
Metal including alloys, all forms	--	1	NA.
Tungsten ore and concentrate	407	437	United States 427; Netherlands 10.
Zinc:			
Ore and concentrate	140,914	125,520	West Germany 59,080; United States 57,077.
Oxide	9,972	11,274	United States 10,688; Canada 158; Guatemala 153.
Metal including alloys, all forms	106,144	104,666	United States 51,038; Brazil 28,506; Venezuela 5,428.
NONMETALS			
Abrasives, natural	505	142	United States 110; Guatemala 30.
Asbestos	(1)	55	Mainly to Canada.
Barite and witherite	122,204	98,227	All to United States.
Clays, crude:			
Bentonite	9	23	Mainly to United States.
Fuller's earth	16,419	14,558	Brazil 5,517; West Germany 2,043; Colombia 1,209.
Kaolin (china clay)	(1)	58	Guatemala 50; Haiti 2.
Other	387	574	Guatemala 170; Colombia 138; United States 80.

See footnotes at end of table.

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Table 2.—Mexico: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Diamond, gem, not set or strung thousand carats	45	--	
Diatomite and other infusorial earth	3,007	2,762	Argentina 948; Brazil 687; Peru 492; United States 159.
Feldspar	2	357	United States 306; Guatemala 50.
Fertilizer materials, crude, phosphatic	2,344	1,021	All to Uhited States.
Fluorspar thousand tons	605	710	United States 574; Canada 88; Brazil 12.
Graphite, natural	45,648	45,136	United States 45,108; Guatemala 28.
Gypsum and plasters thousand tons	1,309	1,535	United States 1,482; Canada 37; China, mainland, 16.
Magnesite	22	237	Dominican Republic 151; United States 44; Venezuela 25.
Mica, crude, including splittings and waste	--	10	All to Dominican Republic.
Perlite, crude	71	91	Brazil 71; Colombia 15; Guatemala 5.
Precious and semiprecious stones, except diamond kilograms	2,095	7,613	Japan 7,214; Netherlands Antilles 217; United States 123.
Salt thousand tons	3,691	4,289	United States 2,472; Japan 1,523; Canada 233.
Sodium compounds, n.e.s.: Caustic soda	([1])	123	United States 90; Haiti 33.
Stone, sand and gravel:			
Dimension stone, crude and partly worked	2,781	3,314	United States 1,224; Italy 1,010; Colombia 481.
Dolomite, chiefly refractory grade	478	502	Guatemala 330; El Salvador 120; United States 52.
Gravel and crushed rock	14,277	16,733	All to United States.
Quartz and quartzite	2,012	339	Do.
Sand, excluding metal bearing	485	7,348	United States 7,276; Ecuador 29; Guatemala 16.
Sulfur, elemental, all forms	1,013	1,235	United States 935; Bahamas 109; United Kingdom 33.
Talc and steatite	190	213	Mainly to United States.
Vermiculite	1,064	1,253	United States 1,251; Colombia 2.
Wollastonite	981	460	Nicaragua 357; United States 102.
Other, crude	39,567	37,243	United States 37,183; Nicaragua 60.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	393	995	All to Belize.
Carbon black	2,781	NA	
Coal, all grades, including briquets	1,438	1,022	Colombia 135; Argentina 123.
Coke and semicoke	3	--	
Gas, hydrocarbon, natural thousand cubic meters	6,175	NA	
Petroleum:			
Crude thousand 42-gallon barrels	74,591	133,247	NA.
Refinery products:[2]			
Gasoline do	1,212	613	NA.
Kerosine do	([1])	20	NA.
Distillate fuel oil do	73	40	NA.
Residual fuel oil do	455	--	
Lubricants do	1,582	--	
Other:			
Mineral jelly and wax do	32,501	--	
Liquefied petroleum gas do	1,920	--	
Pitch do	2	--	
Unspecified do	5	--	
Total do	37,750	673	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	27,661	NA	

NA Not available.
[1] Less than 1/2 unit.
[2] 1978 data are from the International Petroleum Annual, 1978.

Table 3.—Mexico: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite, calcined	28,033	50,302	United States 34,122; Guyana 16,109.
Oxide and hydroxide	108,750	108,489	United States 108,008.
Metal including alloys, all forms	9,243	42,460	United States 30,402; France 5,121; Canada 3,441.
Arsenic metal including alloys, all forms kilograms	37	--	
Beryllium metal including alloys, all forms	12	11	All from United States.
Bismuth metal including alloys, all forms kilograms	203	470	United States 466; Belgium-Luxembourg 4.
Cadmium metal including alloys, all forms do	707	952	United States 522; West Germany 430.
Chromium: Chromite	49,167	50,786	United States 26,996; Cuba 11,500; West Germany 5,813.
Cobalt:			
Oxide and hydroxide	137	129	United States 71; Belgium-Luxembourg 58.
Metal including alloys, all forms	54	56	Belgium-Luxembourg 40; United States 13; Canada 2.
Copper metal including alloys:			
Scrap	17	1,150	All from United States.
Unwrought	50	20,821	United Kingdom 9,229; Netherlands 3,642; United States 3,049.
Semimanufactures	199	134	United States 89; West Germany 38; United Kingdom 5.
Iron and steel:			
Ore and concentrate	7	148,802	Brazil 126,254; United States 22,309.
Metal:			
Scrap thousand tons	356	468	Mainly from United States.
Pig iron and similar materials	23,154	46,340	United States 30,542; Switzerland 10,162; Brazil 4,737.
Sponge iron, powder, shot	1,596	8,010	United States 7,561; Japan 354.
Ferroalloys	2,744	9,375	NA.
Steel, primary forms	26,216	36,596	France 19,453; United States 10,053; West Germany 4,590.
Semimanufactures	19,814	53,386	United States 48,992.
Lead metal including alloys:			
Scrap	330	149	All from United States.
Unwrought	488	129	Mainly from United States.
Semimanufactures	3	3	All from United States.
Magnesium metal including alloys:			
Scrap	25	--	
Unwrought	3,288	2,113	United States 1,200; West Germany 789; Norway 124.
Manganese:			
Ore and concentrate	58,022	37,395	France 28,942; United States 8,453.
Oxides	1,098	572	United States 322; Japan 241.
Mercury 76-pound flasks	--	12	Italy 9; France 3.
Molybdenum:			
Ore and concentrate	459	710	Mainly from United States.
Metal including alloys, all forms	62	259	Do.
Nickel:			
Matte, speiss, similar materials	2,997	2,874	United States 1,983; France 253; Cuba 190; Canada 165.
Metal including alloys, all forms	250	236	United States 176; France 49; Belgium-Luxembourg 5.
Platinum-group metals including alloys, all forms:			
Palladium kilograms	29,641	76,137	Switzerland 50,580; Netherlands 14,036; West Germany 11,000.
Platinum do	12	7	United States 3; Italy 2; Switzerland 2.
Selenium, elemental do	1,003	548	United States 532; West Germany 16.
Tin:			
Ore and concentrate	2,689	3,568	United States 2,000; Singapore 467; United Kingdom 416.
Oxides	38	21	Mainly from United States.
Metal including alloys, all forms	153	257	All from United States.
Titanium:			
Ore and concentrate	1,437	1,944	Canada 1,282; Australia 626; United Kingdom 34.
Ilmenite	40,602	63,572	Australia 57,571; United Kingdom 6,000.
Oxides	287	668	West Germany 348; United States 108; Japan 61.
Slag and residue	--	37	All from United States.
Tungsten metal including alloys, all forms	32	24	Mainly from United States.
Vanadium oxides	124	126	United States 99; Finland 25; West Germany 2.
Zinc:			
Oxide	147	199	Mainly from United States.
Metal including alloys, all forms	74	111	Do.
Other oxides, hydroxides, peroxides of metals	382	489	United States 361; Cuba 66; West Germany 22.

See footnotes at end of table.

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Table 3.—Mexico: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS			
Abrasives, natural	1,155	1,321	United States 1,198; Netherlands 60; West Germany 28.
Asbestos	44,961	60,087	Canada 30,961; United States 17,351; Republic of South Africa 7,740.
Barite and witherite	10,729	525	United States 504; West Germany 21.
Boron materials:			
Crude natural borates	73	429	Peru 400; United States 29.
Oxide and acid	2,120	1,072	Mainly from United States.
Clays, crude:			
Bentonite	1,488	4,522	United States 4,406.
Fire clay	124,790	144,075	United States 141,065; France 1,660.
Kaolin (china clay)	45,507	55,550	United States 54,510.
Cryolite and chiolite	19	55	United States 40; Denmark 10; Switzerland 3.
Diamond, gem, not set or strung ... carats	1,340	335	All from Belgium-Luxembourg.
Diatomite and other infusorial earth	1,672	4	Mainly from United States.
Feldspar	600	725	United States 723; Switzerland 2.
Fertilizer materials:			
Crude, phosphatic ... thousand tons	1,420	1,349	Morocco 947; United States 402.
Manufactured:			
Potassic	72,237	136,166	United States 94,220; Canada 21,000; Spain 20,945.
Other, including mixed	350	1,800	All from Chile.
Graphite, natural	239	164	United States 161.
Gypsum	18,121	24,859	United States 24,712.
Magnesite	18	4,392	United States 3,040; Brazil 1,000; Yugoslavia 333.
Mica:			
Crude, including splittings and waste	196	62	United States 53; Belgium-Luxembourg 6; Brazil 3.
Worked, including agglomerated splittings	24	26	United States 17; Spain 3; Belgium-Luxembourg 2.
Precious and semiprecious stones, except diamond ... kilograms	1,561	69	All from United States.
Salt	1,022	1,378	Mainly from United States.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	53,769	133,559	United States 132,523.
Caustic potash	1,476	2,014	West Germany 983; United States 616; Spain 129.
Stone, sand and gravel:			
Dimension stone: Marble	2,152	4,772	Italy 3,240; Guatemala 1,457.
Dolomite, chiefly refractory grade	35	74	United States 68; West Germany 6.
Quartz and quartzite	1,686	1,523	United States 1,006; Sweden 328; Switzerland 84; France 52.
Sand, excluding metal bearing	303,494	319,230	United States 317,889; Canada 1,264.
Sulfur, elemental, all forms	694	1,111	United States 1,107.
Talc and steatite	118,130	129,131	United States 126,047; Italy 2,481.
Vermiculite	297	608	All from United States.
Other:			
Crude	4,253	4,800	United States 4,567; Australia 233.
Magnesium oxide	164	226	United States 201; West Germany 14; France 11.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,785	--	
Carbon black and gas carbon:			
Carbon black	5,117	NA	
Gas carbon	245	142	All from United States.
Coal, all grades, including briquets	624,991	567,087	United States 341,534; Japan 100,935; Canada 62,715.
Coke and semicoke	41,956	85,304	United States 82,785; Spain 1,000.
Gas, hydrocarbon, natural	35	NA	
Hydrogen, helium, rare gases	141	NA	
Peat, including peat briquets and litter	550	NA	
Petroleum refinery products:[1]			
Gasoline ... thousand 42-gallon barrels	613	44	NA.
Kerosine and jet fuel ... do	([2])	193	NA.
Distillate fuel oil ... do	702	935	NA.
Residual fuel oil ... do	1,094	6,499	NA.
Lubricants ... do	163	733	NA.
Other:			
Mineral jelly and wax ... do	159	--	
Pitch and pitch coke ... do	49	--	
Petroleum coke ... do	975	--	
Bitumen and other residues ... do	48	--	
Bituminous mixtures, n.e.s ... do	8	--	

See footnotes at end of table.

Table 3.—Mexico: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum refinery products:[1] —Continued			
Other —Continued			
Liquefied petroleum gas thousand 42-gallon barrels	7,206	--	
Unspecified do.	665	2,216	NA.
Total do.	11,682	10,620	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	5,960	NA	

NA Not available.

[1] 1978 data are from the International Petroleum Annual, 1978.

[2] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—The high cost of aluminum production held back primary aluminum smelter expansion and was mainly responsible for Mexico's 1978 withdrawal from participation in the proposed joint Mexico-Jamaica Jalumex aluminum smelter project planned for Coatzacoalcos near Veracruz.

Mexico lacks domestic bauxite reserves and must import alumina. In 1979, Industrias Peñoles S.A. de C.V. began testing machinery for a process to extract alumina from nepheline syenite. The proposed project cost was estimated at $600 million and if proved economically feasible would supply at least 300,000 tons of alumina per year.

Peñoles' nepheline syenite reserves are estimated at 3 billion tons, located in the Sierra de San Carlos Mountains in the State of Tamaulipas. About 10 tons of ore produce 1 ton of alumina. Tailings from the alumina extraction process can be used to produce soda ash, potassium, sulphate, and cement.

Cobalt.—In late 1979, Roman Corp. of Canada decided to continue development on Blythwood Mining Co.'s cobalt-gold-silver property located in the State of Sonora. The additional $400,000 investment will bring total cost to $800,000. Diamond drilling was in progress and final feasibility studies were expected to be completed by the end of 1979.

Copper.—Initial production from Mexicana de Cobre, S.A.'s La Caridad copper mine in the State of Sonora was delayed until June of 1979, about 12 years after the project was initiated. The mine was designed to produce 600,000 tons per year of 32% copper concentrate. Concentrate is trucked to the railhead at Nacozari where it is then shipped to port facilities at Guaymas.

Project costs, estimated at $600 million in 1975, have been revised upward to about $1 billion, including the mine, concentrator, molybdenum recovery plant, smelter, refinery, and infrastructure. A 180,000-ton-per-year smelter and a 150,000-ton-per-year refinery are scheduled to come onstream by late 1982. The smelter and refinery sites are located near the Caridad airport, about 40 miles northeast of the mine.

Gold.—In 1978, the Comisión de Fomento Minero, the State mining development agency, announced plans to renovate the Pinzon Dorado gold mining operation. The mine, located in the State of Guerrero, has not been operational for about 30 years. By 1980 the mine is expected to produce 32,000 ounces of gold annually and employ around 200 persons. The Pinzon Dorado operation would be the only Mexican mine worked exclusively for gold.

Iron Ore.—Recoverable reserves of iron ore contain about 225 million tons of metallic iron. Potential reserves have been estimated at about 57 million tons of metallic iron.

In 1978, it was estimated that maximum mining capacity equaled about 15 million tons of ore annually. The ore beneficiating capacity in 1978 was estimated at about 13 million tons annually. In 1978 Mexico was the third most important producer of iron ore in Latin America after Brazil and Venezuela.

Exploration for additional reserves continued as well as investigations to secure foreign sources of iron ore. In 1979 it was reported that Mexico may obtain iron ore

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from Brazil in exchange for crude oil.

Iron and Steel.—In September 1979, the three State-owned or controlled integrated steel companies were formally merged into one holding company, Sidermex. Two of the companies, Altos Hornos de Mexico S.A. (AHMSA), and Siderúrgica Lazaro Cardenas Las Truchas, S.A. (SICARTSA), are fully State-owned, and the Government holds a 44% controlling interest in the third company, Fundidora de Monterrey, S.A. The three companies remain separately managed but all other administration including planning, coordination, production, finances, and marketing have been under Sidermex control since January 1978. Improvements through Sidermex control were evident in 1978-79 as output increased and financial losses decreased.

In 1979 both private and State-owned steel industries were involved in expansion programs. Tubos de Acero, S.A. (TAMSA), planned a 6-year, $650 million investment to double steel output. Hojalata y Lamina S.A. (HYLSA), has scheduled $750 million over 5 years to increase steel production from 1.5 million tons to 2.5 million tons. Sidermex had a multibillion dollar program underway designed to bring installed capacity to 11.7 million tons of steel by 1982. Sidermex envisions a production capacity of 24 million tons of steel by 1990.

In 1979 Mexico accounted for 43% of the total sponge iron production in Latin America. This represented a decrease from Mexico's share of 63% in 1978 because of increased production in Argentina, Brazil, and Venezuela. Mexico was the only producer of sponge iron until 1973, when Brazil began production.

Natural gas as an energy source figures prominently in iron and steel expansion planning. About two-thirds of Mexico's future steel industry will be on the east coast, convenient to both ports and large gas pipelines.

Lead and Zinc.—In 1978, subsidiaries of the newly formed holding company Grupo Industrial Minera Mexico, S.A. (GIMMSA), jointly obtained a $200 million loan from a consortium of nine Mexican, Canadian, and United States banks, including the Bank of America.

Industria Minera Mexico, S.A. (IMMSA), the largest of GIMMSA's subsidiaries, planned to use $120 million of the loan to help finance the completion of the 113,000-ton-per-year electrolytic zinc refinery at San Luis Potosí. Construction work on the refinery resumed in 1979 with initial shipments to start near the end of 1981 and reach full capacity in 1982 or 1983. The plant will also refine almost 1,400 tons per year of cadmium metal. By 1983, zinc concentrate production was expected to be sufficient to supply both the new refinery and the Nueva Rosita refinery, and still provide over 100,000 tons per year for export.

The remaining $80 million of the GIMMSA loan was allocated to the other subsidiaries for a general program of modernization and expansion of existing mines and plants during the period 1978-81. The loan represented the largest unsecured and unguaranteed private sector loan in Mexico's history.

Manganese.—In 1978, La Compañía Minera Autlán S.A., one of the principal ferroalloy producers in Latin America, acquired the manganese alloy plant of Airco Alloys, Inc. in Mobile, Ala., United States. The purchase took place through Autlán's subsidiary, Autlán Manganese Corp. Autlán's manganese deposits at Molando, near Tampico, will provide material for use in Alabama as well as in its Mexican operations.

Molybdenum.—Minera Frisco, S.A. de C.V., a holding company with nine subsidiaries, became wholly Mexican owned in 1978 when investors purchased the 30% interest held by Union Corp. of England. The company announced that it planned an investment of $23 million to develop Mexico's first molybdenum mine at Cumobabi in Sonora, south of the Cananea and Caridad copper mines. Plans called for a mine production of 600 tons of ore per day in 1980, increased to 1,200 tons per day by 1981. Total reserves from several orebodies were estimated at 10 million tons averaging 0.25% of molybdenum. Capacity ore production of 1,200 tons per day would yield about 2 million pounds of molybdenum per year.

Mexicana de Cobre's molybdenum recovery plant has been scheduled for completion by late 1981. it will produce about 2,000 tons per year of molybdenum sulphide from the La Caridad copper project.

Silver.—Uncertain world economic conditions coupled with increased industrial consumption and coin mintage stimulated both the demand and price for silver in 1978-79.

This favorable silver market enabled many small and medium-sized mines to open or expand operations. The larger silver producers continued exploration and development work on new and old properties, increasing ore reserve estimates, initiating new mining projects, and expanding production facilities at others.

In late 1979 construction began on the old Real de Angeles open pit mine expansion project at Zacatecas. This deposit, with a present estimate of 59 million tons of ore reserves, is owned by Minera Real de Angeles, S.A. de C.V., a joint venture of the Comisión de Fomento Minero (33%), Minera Frisco S.A. de C.V. (33%), and Placer Development Ltd. (34%). The ore averages 2.4 ounces per ton of silver, 1% lead, 0.9% zinc, and 0.015% cadmium.

First production from the mine has been scheduled to begin by the end of 1981 or early 1982. Planning included a 10,000-ton-per-day concentrator to come onstream in 1982, by which time it was estimated that 7 million ounces of silver per year would be produced. Lead production was forecast at 31,000 tons per year, zinc production at 26,000 tons, and cadmium production at 415 tons per year. Given the present ore reserves estimate and proposed mining rate, the mine has a life expectancy of 17 years. Initial investment was estimated at nearly $150 million. Total investment could eventually reach $250 million and employ 500 workers.

Uranium.—Reports on Mexico's uranium reserves have not always been consistent. The Mexican Government official estimate as of the end of 1979 included 8,823 tons of proven reserves and approximately 150,000 tons of potential reserves. Most deposits are all located in northern Mexico, especially in the State of Chihuahua. Other deposits have been located in the States of Nuevo Leon, Sonora, and Durango. Active exploration was underway in many areas since it was estimated that only about one-tenth of Mexico has been surveyed for radioactive minerals.

A 3,000-ton-per-day mill has been planned for the Las Margaritas Mine near Villa Aldema at an estimated cost of about $33.7 million. The yield from about 900,000 tons per year of ore was calculated to be between 800 tons and 1,000 tons of uranium oxide.

NONMETALS

Cement.—Production of cement during 1978-79 failed to keep up with demand and spurred plant expansion programs. The Government estimated new cement construction and expansion programs would produce at least 20 million tons per year by 1982. In 1979 total plant capacity reached 15.6 million tons per year from 28 active plants, of which 25 were independent and 3 were cooperatives.

The Government introduced an incentive program for cement producers which are majority Mexican-owned. These incentives included a subsidy of up to 75% of ad valorem duty on imports of capital goods and equipment not available locally. Some firms may claim accelerated depreciation for certain productive equipment and installations.

Fertilizer Materials.—In 1979 Roca Fosforica Mexicana, S.A. de C.V. (ROFOMEX), a State-operated company, began construction on a 5,000-ton-per-day concentrator at the new phosphate mine at San Juan de la Costa in Baja California. The mine was expected to come onstream in 1980. Ore reserves were estimated at about 50 million tons. The open pit mine will evolve into an underground mine using the room-and-pillar technique. Annual concentrate production was expected to reach 750,000 tons with a maximum P_2O_5 content of 31%. The plant will also produce 200,000 to 300,000 tons per year of ground phosphate rock for direct application. Capital investment was estimated at $60 million.

Basic plant engineering and exploration work preparatory to exploitation continued on the low-grade Santo Domingo phosphate deposits also located in Baja California. Ore reserves were estimated at 1,450 million tons. Initial production has been scheduled for 1982 at 1.5 million tons per year of concentrate. By the mid-1980's concentrate production is expected to be 4.5 million tons per year. Capital investment for the operation was expected to be $60 million.

Ventures of this nature are encouraged by the Government to lessen the need to import minerals available domestically. At full production, the San Juan de la Costa project should decrease phosphate imports by 50% with self-sufficiency expected when the Santo Domingo plant comes onstream. When the Santo Domingo project is fully developed, around 1986, phosphate should become available for export.

Fluorspar.—In 1978, increased domestic consumption and the onset of Canada as an important importer due to its cessation of fluorspar production aided Mexico's depressed fluorspar industry to a small extent. Total production was about 69% of installed capacity and companies refrained from expansion programs. In 1979, demand increased but producers were not able to take full advantage of improved markets due to the persistant rail transportation problems.

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MINERAL FUELS

Coal.—It was reported that Mexico's total coal reserves now amount to 2 billion tons, three-fourths of which are located in the State of Coahuila. The steel and metallurgical industries utilized about 95% of all coal consumed in Mexico and electric powerplants use about 3% to produce 4% of the total electricity generated. New coal-fired electric plants are under construction, and by 1986 coal-fired plants could account for 10% of total installed generating capacity.

Coal production has continued to increase but not enough to satisfy the growing domestic demand. The loss of foreign exchange due to increased coal and coke importation is expected to be offset by the increased export of end products and the decreased import of steel products as their domestic manufacture is initiated.

Petroleum.—By the end of 1979 the official Petróleos Mexicanos (Pemex) estimate of proven reserves was 45.8 billion barrels of crude oil, natural gas liquids, and natural gas equivalents, a 14% increase over 1978 estimates. Probable reserves were estimated at 45.0 billion barrels and possible reserves (including both proven and probable) were placed at 200 billion barrels. Increased reserves can be attributed primarily to the Southern Zone, the Chicontepec Paleocanal in the northern part of the State of Veracruz, and the Sabinas Basin in Coahuila. Exploration was ongoing or planned for all onshore and offshore areas in Mexico where studies indicated the possibility of hydrocarbon deposits.

On June 3, 1979, an exploratory well in the Gulf of Campeche, the Ixtoc 1, went out of control spilling crude oil; some of which ultimately was carried northward to the United States coastline. It was estimated that about 3 million barrels of crude oil escaped. Capping efforts were on the verge of completion and complete cessation of the spill was expected early in 1980.

In Mexico's Southern Zone, crude oil production from the Gulf of Campeche was initiated in mid-1979. By the end of December production amounted to about 240,000 barrels per day. Crude oil production from the Southern Zone represented 87% of total national production. About 70% of total natural gas production in 1979 came from the Southern Zone.

Prior to 1975, the shallower formations of the Chicontepec Area in the Central Zone were regarded as having minimal production potential and were bypassed in favor of deeper production. In 1978, after a lengthy reexamination of old records and the drilling of new test wells, these Tertiary layers of alternating sand and shale were believed to contain as much as 100 billion barrels of oil. Pemex development plans included almost 16,000 wells to be drilled on 2,285 sites over a period of about 13 years.

In 1979 construction was completed on what has been described as the largest diameter gasline laid to date in the Western Hemisphere. A 48-inch pipeline was extended northward for 683 miles from Cactus, in the Reforma Zone, to San Fernando where it was decreased to 42-inch-diameter pipe for 155 miles to Monterrey. Line capacity is 2.7 billion cubic feet of gas per day. Another 74-mile branch of 42-inch-diameter pipe was nearly completed from San Fernando to Reynosa to link up with U.S. transmission systems.

At the end of 1979 Mexico had nine oil refineries in operation. The Tula refinery came onstream in 1978 and the Cadereyta and Salina Cruz refineries were operational in 1979. Total crude oil refining capacity at the end of 1979 equaled almost 1.4 million barrels per day.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Mexican pesos (Mex$) to U.S. dollars at the rate of Mex$22.77 = US$1.00 for 1978 and Mex $22.81 = US$1.00 for 1979.

The Mineral Industry of Morocco

By Janice L. W. Jolly[1]

Mineral Production in Morocco contributed about 6% to the value of the Nation's 1978 Gross Domestic Product (GDP) of $12.9 billion[2] at current prices. By 1979, Morocco was entering its third year of tight Government fiscal and monetary policies designed to restore balance to the economy. Investment in the industrial sector (excluding the priority areas of phosphate and petrochemicals) dropped from $497 million in 1977 to $265 million in 1978. Low prices for phosphate rock and the unrest in the Sahara continued to plague the economy. Even so, the mineral industry continued to receive priority Government funding. Several loans and other financing were arranged during 1978-79 for the continued phosphate mine expansion and development of phosphate processing. Morocco eventually hoped to process 30% of its phosphate production. Prospecting for new cobalt reserves was active, and plans for a new calcination kiln were being studied. The Government continued to improve and expand Morocco's ports, including new facilities at Jorf Lasfar, Agadir, TanTan, El Aaiun, Boujdour, and Tarfaya. A new port was also under construction at Nador as plans for expansion of the iron and steel industry were proceeding. Plans were also continuing for the expansion of the lead foundry at Oued El Heimer and for a new smelter at Meknes. Uranium prospecting continued, and plans for the recovery of uranium from phosphate rock were being finalized. Discovery of oil in the Taza Region was giving new impetus to petroleum prospecting. Negotiations for an agreement were also nearly concluded with Occidental Petroleum of the United States for the development of Morocco's extensive oil shale deposits as well as for oil exploration and phosphate sector development. The Bou Skour copper mine was closed.

In 1978, Morocco undertook strict measures to reduce the trade imbalance. Investment authorization was reduced by about 30%, thereby reducing the need for imports of capital goods such as industrial equipment and construction materials. A more modest 1978-80 development plan was designed to conserve foreign exchange. Import restrictions and licensing were placed on numerous items, and firms were required to make a 25% 6-month deposit for all imported goods. This retrenchment policy had a marked effect on the commercial trade deficit for 1978, and also produced some dislocations in the domestic economy. The Government policy of reduced investment spending was expected to continue through 1980 along with slower expansion of the money supply and continued import restrictions.

The Moroccan Investment Code offered inducements to firms prepared to accord local partners at least half ownership plus board chairmanship. In such priority sectors as mining, 100% foreign ownership was authorized, while still permitting foreign firms to profit from code incentives. To encourage the eventual decentralization of Moroccan industry, even more favorable investment terms were available to firms willing to locate their operations outside the dominant Casablanca-Rabat industrial area. Also, for any new investments in excess of $7.7 million, advantages in addition to those specified by the code could be negotiated with the Government.[3]

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A commission was studying the possibility of constructing new roads between Morocco, Bou Craa, and Mauritania. About $800 million was to be spent on a new road between Marrakech and El-Aaium for use in transporting phosphate concentrates. Feasibility studies were expected to be finished by 1980. The Soviet Union was also building a new road from Meskala to Essaouria for phosphate transport. In the long term, the Government of Morocco expected to complete its portion of the Transafrica Highway, which links Tangier with Dakar, Senegal. This highway will pass through Agadir, Tarfaya, El Aaiun, Guelta Zemour, Mijilic, Zouerate, Atar, Akoujt, and Nouakchott.

Morocco was a member of the Arab Organization for Mineral Resources (AOMR), which held its fourth meeting in Mohammedia on February 24, 1979. Formed in 1972, the AOMR also included Jordan, the United Arab Emirates, Saudi Arabia, Kuwait, Iraq, Mauritania, and the Palestine Liberation Organization. Tunisia, Sudan, and Qatar had applied for membership.

The Moroccan National Economic Development Bank (BNDE) secured several loans for industrial and mineral development from the international banking community during 1978 and 1979. These included a $7.25 million loan from the Abu Dhabi Fund for Arab Economic Development (FADEA), a $200 million loan from Canada, $300 million from seven banks, headed by Bank of America International Ltd., $53 million from Japan, $2 million from the OPEC special fund, and $150 million from Midland Bank. The World Bank also approved a $25 million loan to assist in an integrated small industry development program.

PRODUCTION AND TRADE

The mining sector registered an overall increase in production for both 1978 and 1979, but production of certain minerals declined. Iron ore production for both years continued to be affected by the slump in the world iron ore market. Production and exports of anthracite, pyrrhotite, fluorite, and barite improved in 1978, compared with 1977, while copper, lead, cobalt, zinc, and manganese production remained at somewhat similar levels. The first 6 months of 1979 saw an increase in both production and exports of copper, lead, zinc, barite, pyrrhotite, and silver. Both fluorspar and barite experienced slight decreases in mine production as a result of slower markets. Manganese production remained at about the same level as in 1978 with exports increasing slightly. Mineral production, excluding petroleum, natural gas, and cement, was valued at $701 million in 1978.

Phosphate production and exports for 1978 increased by 9% in volume, but the decline of the U.S. dollar, in which phosphate contracts were written, and a continued weak world phosphate market caused receipts to fall from 1977 levels. In 1978, a total of 17.3 million tons of phosphate rock was exported to Spain (16%), France (12%), Belgium-Luxembourg (8%), Poland (6%), Italy (5%), and other European countries. U.S. phosphate rock imports from Morocco increased sharply owing to Beker Industries' contract with Morocco to purchase material for phosphoric acid production. Exports to the United States were 923,800 tons in 1978, placing the United States in sixth place among Morocco's customers. Mainland China was the largest importer of Moroccan fertilizer in 1978. The value of phosphate rock exports was estimated at $508.5 million for 1978, compared with $536 million for 1977. Phosphate rock exports formed 25% of the 1979 export value, compared with 32% of the 1978 total export value.

Total exports were valued at $1,565 million and total imports were valued at $3,100 million for 1978. The 1978 foreign trade deficit was about 40% lower than in 1977. Total exports for the first 6 months of 1979 were valued at $918 million compared with $820 million for 1978. Crude petroleum imports were valued at $314 million for 1978 and $206.5 million for the first 6 months of 1979. Energy imports formed 80% of local consumption. The U.S. share of Moroccan 1978 imports increased to form 12.9% of the total, while the U.S. share of exports was 2.8%. On July 6, 1979, Morocco signed a 5-year commercial agreement with the Soviet Union. The Soviet Union was one of Morocco's leading trade partners with a two-way trade reaching $75 million. This new agreement followed the 1977 Soviet agreement for Meskala phosphate development.

Table 1.—Morocco: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Antimony concentrate:				
Gross weight	3,723	3,355	5,265	6,036
Metal content	1,405	1,409	2,211	2,100
Cobalt concentrate:				
Gross weight	7,185	7,805	8,719	6,978
Metal content	934	1,015	1,134	900
Copper concentrate:				
Gross weight	16,380	12,112	12,217	12,200
Metal content	[e]4,914	4,845	4,657	4,600
Iron and steel:				
Iron ore, direct-shipping grade, gross weight	342,763	441,044	58,938	6,096
Pig iron[e]	10,000	12,000	12,000	12,000
Steel[e]	1,000	--	--	--
Lead:				
Concentrate:				
Gross weight	98,686	155,685	167,054	200,000
Metal content	60,198	93,411	100,230	120,000
Metal, smelter, primary	26,380	33,136	28,518	30,000
Manganese ore, largely chemical grade	117,304	113,547	126,200	136,000
Nickel, Ni content of cobalt ore[e]	146	156	174	170
Silver, mine output, metal content thousand troy ounces	2,054	2,254	2,315	[2]2,418
Zinc concentrate:				
Gross weight	29,568	22,153	12,217	40,000
Metal content	17,740	7,754	4,276	14,000
NONMETALS				
Barite	129,215	149,920	176,813	230,000
Cement, hydraulic thousand tons	2,324	2,870	2,819	[2]3,084
Clays, crude:				
Bentonite	4,664	4,807	4,800	NA
Smectite	36,768	21,025	8,000	NA
Other, including fuller's earth	3,768	NA	2,065	NA
Fluorspar	51,450	40,000	54,200	59,000
Mineral water cubic meters	28,064	24,213	20,400	[2]46,007
Phosphate rock:				
Morocco proper thousand tons	15,656	17,572	19,713	20,000
Western Sahara do	173	232		
Pigments, mineral: Natural iron oxide (goethite)	14	35	[e]20	25
Pyrite and pyrrhotite, gross weight	76,242	149,972	190,400	187,000
Salt, all types	21,430	12,442	34,813	NA
Sulfur, S content of pyrite	[e]22,870	44,992	61,000	60,000
MINERAL FUELS AND RELATED MATERIALS				
Coal, anthracite thousand tons	702	707	720	710
Fuel briquets do	9,960	7,962	[e]7,000	NA
Gas, natural:				
Gross million cubic feet	1,730	3,037	2,898	[2]2,666
Marketed do	[e]1,500	3,002	2,800	2,600
Petroleum:				
Crude thousand 42-gallon barrels	62	167	181	[2]142
Refinery products:				
Gasoline do	3,177	3,411	2,017	[2]3,810
Jet fuel do	594	1,788	1,196	[2]2,028
Kerosine do	1,050	NA	550	[2]506
Distillate fuel oil do	5,506	5,200	5,081	[2]8,838
Residual fuel oil do	7,524	8,358	9,412	[2]12,399
Other do	1,499	1,070	833	1,200
Refinery fuel and losses do	1,331	1,160	1,126	1,650
Total do	20,681	20,987	20,215	30,431

[e]Estimate. [p]Preliminary. NA Not available.

[1] In addition to the commodities listed, a variety of crude construction materials is also produced, but available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

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Table 2.—Morocco: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS			
Aluminum metal including alloys, all forms	763	989	France 260; West Germany 191.
Antimony ore and concentrate	3,795	3,495	Yugoslavia 1,841; United Kingdom 674; Belgium-Luxembourg 349; France 82
Cobalt ore and concentrate	8,550	9,076	All to France.
Copper:			
Ore and concentrate	22,700	18,095	West Germany 12,521; U.S.S.R. 2,500.
Metal including alloys, all forms	1,558	906	France 376; West Germany 264; Belgium-Luxembourg 155.
Gold, waste and sweepings thousand troy ounces	--	1,118	All to United Kingdom.
Iron and steel:			
Ore and concentrate	60	--	
Roasted pyrite	338,423	429,342	Greece 134,205; Netherlands 104,570; Switzerland 89,385; West Germany 43,650.
Metal:			
Scrap	r49,954	18,648	Spain 16,956.
Pig iron, including cast iron	--	1,801	Italy 1,000; France 801.
Sponge iron, powder, shot	960	--	
Ferroalloys	--	15	All to Netherlands.
Semimanufactures	(1)	1	Mainly to France.
Lead ore and concentrate	71,239	120,571	France 28,796; Tunisia 20,380; West Germany 16,628; Spain 15,766.
Manganese ore and concentrate	104,438	130,633	Netherlands 29,225; France 28,486; West Germany 17,915; United States 15,275; Spain 13,078.
Silver metal including alloys value, thousands	r$242	$253	United Kingdom $129; Switzerland $124
Zinc ore and concentrate	19,091	21,115	Italy 8,585; France 7,538; West Germany 2,242.
Other:			
Ores and concentrates	1,680	2,080	All to France.
Ash and residue containing nonferrous metals	6,082	474	Spain 263; France 210.
Oxides, hydroxides, peroxides of metals	9	5	Libya 3; France 1.
NONMETALS			
Barite and witherite	r119,556	181,244	United States 92,734; United Kingdom 32,530; Netherlands 18,400.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	1	50	All to United Kingdom.
Fire clay	6,463	15,298	NA.
Fuller's earth	12,815	13,893	Spain 9,982; Tunisia 2,635.
Other	--	122	Mainly to Netherlands.
Products:			
Refractory (including nonclay brick)	3,718	2,041	Lebanon 683; Tunisia 380; Iraq 300; Senegal 197.
Nonrefractory value	r$2,436	$2,634	Mauritania $2,398.
Fertilizer materials, phosphatic:			
Crude thousand tons	14,684	15,784	Spain 2,676; Belgium-Luxembourg 2,000; France 1,618.
Manufactured	156,410	173,265	China, mainland, 50,450; France 26,791; West Germany 25,614; Belgium-Luxembourg 22,500.
Fluorspar	27,548	78,201	West Germany 27,692; U.S.S.R. 15,456; United States 11,387; Canada 7,682
Gypsum and plasters	149,312	175,557	Nigeria 62,336; Japan 30,000; Kuwait 24,000; Portugal 22,324.
Lime	--	24	Mauritania 20; United Kingdom 4.
Pigments, mineral, including processed iron oxides	(1)	--	
Precious and semiprecious stones, natural and manufactured value	r$816	$168	France $104; West Germany $64.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	2,682	2,982	Italy 2,181; Togo 568.
Worked	2	1	Mainly to France and United States.
Gravel and crushed rock	15,212	21,781	NA.
Sand, excluding metal bearing	2,988	9,025	NA.
Mica, crude, including splittings and waste	13	10	All to France.
Other:			
Slag, dross, and similar waste, not metal bearing	--	84	Do.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	5,721	9,803	Nigeria 6,838; Liberia 2,214.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,191	3	Mainly to United Kingdom.
Coal, all grades, including briquets	30,030	56,769	United Kingdom 19,875; Netherlands 17,660; Tunisia 12,585.

See footnotes at end of table.

Table 2.—Morocco: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum refinery products:			
Gasoline ------ thousand 42-gallon barrels	^{r}148	35	Mainly to Spain.
Kerosine do	^{r}560	503	NA.
Distillate fuel oil do	596	106	NA.
Residual fuel oil do	104	191	NA.
Lubricants do	2	3	NA.
Other:			
Light oils do	--	(1)	NA.
Unspecified do	--	1	NA.
Total do	1,410	839	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	(1)	(1)	Mainly to France and Switzerland.

^{r}Revised. NA Not available.

[1] Less than 1/2 unit.

Table 3.—Morocco: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1976	1977
METALS			
Aluminum:			
Oxide and hydroxide		1,415	2,431
Metal including alloys, all forms		6,554	7,224
Antimony metal including alloys, all forms		12	9
Arsenic trioxide, pentoxide, acids		(1)	10
Bismuth metal including alloys, all forms	kilograms	69	198
Cadmium metal including alloys, all forms	do	1,013	517
Chromium:			
Ore and concentrate		25	60
Oxide and hydroxide		5	10
Metal including alloys, all forms	kilograms	2	32
Cobalt:			
Oxide and hydroxide	do	496	675
Metal including alloys, all forms	do	104	88
Copper:			
Copper sulfate		1	3
Metal including alloys, all forms		6,210	7,673
Gold metal, unworked or partly worked	value, thousands	$2,361	$2,466
Iron and steel metal:			
Scrap		218	705
Pig iron, including cast iron		3,690	3,268
Sponge iron, powder, shot		257	307
Ferroalloys		492	452
Steel, primary forms		25,958	23,104
Semimanufactures:			
Bars, rods, angles, shapes, sections		325,377	397,531
Universals, plates, sheets		^{r}104,764	125,500
Hoop and strip		^{r}14,016	23,237
Rails and accessories		34,821	38,137
Wire		7,187	8,739
Tubes, pipes, fittings		^{r}31,999	30,892
Castings and forgings, rough		8	84
Total		518,172	624,120
Lead:			
Oxide		286	417
Metal including alloys:			
Scrap		(1)	--
Unwrought		309	5
Semimanufactures		115	186
Lithium:			
Oxide		6	22
Elemental	kilograms	17	8
Magnesium metal including alloys, all forms	do	1,850	2,141

See footnotes at end of table.

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Table 3.—Morocco: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS —Continued		
Manganese:		
Ore and concentrate	213	488
Oxide	136	159
Metal including alloys, all forms ... kilograms	--	143
Mercury:		
Oxide ... do	47	30
Metal ... 76-pound flasks	17	91
Molybdenum:		
Oxide ... kilograms	8	36
Metal ... do	93	304
Nickel:		
Matte, speiss, similar materials	1	4
Metal including alloys:		
Unwrought	14	2
Semimanufactures	640	1,215
Platinum-group metals including alloys ... value	$61	$910
Rare-earth metals:		
Compounds, not further described ... kilograms	408	720
Metals including alloys ... do	348	9
Selenium, elemental ... do	202	729
Silver metal including alloys ... value, thousands	$22	$57
Tin:		
Oxide ... kilograms	20	60
Metal including alloys, all forms	199	161
Titanium:		
Oxide	1,222	1,460
Metal including alloys, all forms ... kilograms	2,332	116
Tungsten metal including alloys, all forms ... do	343	36
Vanadium oxide ... do	593	--
Zinc:		
Oxide	533	377
Metal including alloys:		
Scrap ... kilograms	9	15
Blue powder	51	110
Unwrought	2,055	2,226
Semimanufactures	98	437
Zirconium metal including alloys, all forms ... kilograms	--	42
Other:		
Ores and concentrates	(1)	--
Oxides, hydroxides, peroxides of metals ... kilograms	1,516	960
Uranium and thorium compounds, not further described ... do	2	1
Metals including alloys, all forms:		
Cermets ... do	--	12
Gallium, indium, thallium ... do	90	--
Tellurium and arsenic ... do	4,055	2,060
Metalloids, n.e.s. ... do	285	125
Pyrophoric alloys ... do	645	730
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	39	14
Grinding and polishing wheels and stones	373	446
Asbestos	6,221	7,812
Barite	--	(1)
Boron materials:		
Crude natural borates	841	707
Oxide and acid	5	9
Bromine ... kilograms	175	70
Cement	689,053	1,141,891
Chalk	4,994	5,365
Clays and clay products (including all refractory brick):		
Crude:		
Bentonite	2	500
Fire clay	12,263	7,414
Fuller's earth	--	1
Kaolin (china clay)	4,583	4,054
Other	527	340
Products:		
Refractory (including nonclay brick)	[r]5,111	9,944
Nonrefractory	7,425	16,614
Cryolite and chiolite	(1)	--
Diamond, gem, not set or strung ... value	$1,066	--
Diatomite and other infusorial earth	426	97
Feldspar	25	58
Fertilizer materials, crude and manufactured:		
Nitrogenous	192,964	190,488
Phosphatic ... kilograms	10	279
Potassic	59,241	61,835
Other, including mixed	[r]20,724	860
Graphite, natural	11	5
Gypsum and plasters ... kilograms	490	159

See footnotes at end of table.

Table 3.—Morocco: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
NONMETALS —Continued		
Iodine kilograms	150,648	357
Lime	10,432	9,206
Magnesite	291	205
Mica:		
Crude, including splittings and waste	[r]23	18
Worked, including agglomerated splittings	3	1
Pigments, mineral, n.e.s.:		
Natural, crude	504	401
Iron oxides, processed	630	811
Precious and semiprecious stones, synthetic value	$6,962	$7,972
Pyrite	--	10
Salt	4	7
Sodium and potassium compounds, n.e.s.:		
Sodium hydroxide	13,070	11,753
Potassium hydroxide	192	126
Peroxides of potassium and sodium kilograms	232	191
Stone, sand and gravel:		
Dimension stone	827	2,391
Dolomite, chiefly refractory grade	960	790
Gravel and crushed rock	436	2,301
Quartz and quartzite	5	27
Sand, excluding metal bearing	19,812	26,798
Sulfur:		
Elemental, all forms	183,342	457,814
Sulfur dioxide	(1)	41
Sulfuric acid	71,869	139
Talc, steatite, soapstone, pyrophyllite	1,270	1,049
Other:		
Crude:		
Vermiculite, perlite, chlorite	--	30
Unspecified	179	224
Oxides and hydroxides of magnesium, strontium, barium	12	11
MINERAL FUELS AND RELATED MATERIALS		
Carbon black and gas carbon	187	5,169
Coal and coke, including briquets	38,411	31,358
Hydrogen, helium, rare gases	20	26
Peat, including peat briquets and litter	386	504
Petroleum:		
Crude thousand 42-gallon barrels	20,758	21,112
Refinery products:		
Gasoline do	[r]23	75
Kerosine do	[r](1)	--
Distillate fuel oil do	1,443	2,956
Residual fuel oil do	194	77
Lubricants do	[r]247	332
Other:		
Liquefied petroleum gas do	1,250	1,710
White spirit do	30	35
Mineral jelly and wax do	119	142
Nonlubricating oils, n.e.s do	5	5
Bitumen and other residues do	(1)	(1)
Bituminous mixtures, n.e.s do	4	6
Unspecified do	7	8
Total do	3,322	5,346
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	907	832

[r] Revised.
[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Cobalt.—Morocco produced about 6% of the world's total cobalt. The Bou Azzer mine, operated by the Compagnie de Tifnout-Tiranamine (CTT), produced 7,805 tons of cobalt concentrate in 1977, 8,719 tons in 1978, and 6,798 tons in 1979. The cobalt sulfide concentrate ranges from 10% to 14% cobalt. Despite higher prices for cobalt, CTT was not expected to expand production beyond about 11,000 tons in the next few years because of limited reserves. However, prospecting was active and the expectation of proving new reserves was high. CTT was planning to construct a calcination kiln which would process the cobalt concentrate at Bou Azzer. The concentrate was being sent to France for final processing. CTT was owned 63% by Om-

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nium Nord Africain (ONA) and 37% by Bureau de Recherches et de Participation Minières (BRPM).

Copper.—Feasibility studies were continuing for the construction of a copper smelter and refinery at the port of Agadir, although the austerity budget for the 1978-80 3-year plan allotted no funds for construction. The smelter, a project of the Fonderie Marocaine de Ciuvre (SOFOMAC) company, was to have a 30,000-ton-per-year capacity. The Arab Mining Company, financed by 12 Arab nations, planned to invest in 25% of the project. Development at the Bleida copper mining project by the Société Minière de Bou Saffer (SOMIFER) was also progressing. The Bleida mine was to have a mine output of about 200,000 tons of copper ore per year. A concentrator would produce about 16,000 tons per year of copper concentrates. Low copper prices in 1977, combined with poor ore grade, brought about the closing of the Bou Skour copper mine, operated by Ste. des Mines de Bou Skour. The Bou Skour had been the second largest copper producer.

Iron and Steel.—Morocco's iron ore resources of about 142 million tons were distributed in 10 small deposits. Near Nador in northern Morocco there were the Qiukchane, Setolazar, and Mellilia deposits; in central Morocco, there were the Bou Azel and Bou Guergour (near Katfara), Tourza (near Quarzazate), Air Amar (near Wadizam), and Kettara deposits; in southwestern Morocco, there were the Ait Ahmane and Tachilla deposits (near Agadir). The Nador pellet plant of Société d'Exploitation des Mines de Rif (Seferif) had a capacity of 850,000 tons per year but had never exceeded 500,000 tons per year. All of the pellet plant production, which uses Quikchane ore, was exported. Exploitation of other deposits depended upon whether Société Nationale de Sidurgie (SONASID) plans for domestic steelmaking developed. The plan to build a steel plant at Nador—a project in the books since 1948—was given the final go-ahead in late 1979. The $82 billion cost was to be spread over 7 years. A new port to service the iron and steel industry of Nador was under construction by the Romanian enterprise Contransimex. The new Nador port was expected to have an annual average traffic of 2 to 2.5 million tons by 1985.

The Moroccan company Sidema started up a new steel plant for reinforcing bars in Tangier, with 60,000-ton-per-year capacity. Sometal's reinforcing bar plant, started in 1971, produced 45,000 tons per year from imported billets. About $9.3 million was also to be spent for an iron plant at E Jadkja. This would be established by a new company, Metalam, in which Intemaxim of Lichtenstein had a minority interest.

Lead and Zinc.—The Draa Sfar lead-zinc mine, located 15 kilometers northwest of Marrakech, was officially opened in December 1978. The mine was to process 81,000 tons of crude ore per year, yielding 3,000 tons per year of lead concentrate and 7,500 tons per year of zinc concentrate. The Draa Sfar mine was an old mine which had been reactivated after new reserves had been proven. Two important ore bodies were discovered. The first contained reserves of 335,000 tons, containing 3.17% lead, 6.1% zinc, and 300 grams of silver per ton. The second had reserves of 280,000 tons with 6.7% zinc and 0.4% lead. The 1978 lead concentrate output of the Compagnie Minière de Toussit (CMT) reached 72,150 tons in 1978, compared with 60,392 tons in 1977. CMT exploited the Beddiane and Oued Mekta mines of Oujda Province. Exploitation of a million-ton silver-lead deposit began in 1979 at Sidi Lahcen, located near Oujar. The deposit was to yield 6,500 per yield of silver-lead concentrate and to be mined by the Arab Mining Company. The company's capital was shared by Morocco, Saudi Arabia, Jordan, Sudan, Libya, and Iraq. The Arab Mining Company was also to develop the Zgounder deposit near Quarzazate. Plans were continuing for the expansion of the lead foundry at Qued El Heimer and for the new smelter to be built near Meknes.

Tungsten.—On December 14, 1978, Morocco's BRPM signed an agreement with the West German company Klockner under which it will explore tungsten deposits at Azegour, located in the Marrakech area. The terms of the agreement included an expansion program to prove reserves and the possibility of setting up a joint venture with BRPM and Klockner as partners. The agreement also provided for cooperation with regard to exploration and exploitation of uranium in Morocco.

Uranium.—Several uranium occurrences had been located in the Upper Atlas. A Japanese mission was carrying out a 3-year exploration project in the Upper Moulaya region, where drilling had uncovered encouraging signs of uranium mineralization in 1977. Another discovery was made by the BRPM in the Imintanout Circle, south of Chichaoua. Negotiations for the construction of a plant at Safi to recover uranium from phosphoric acid continued during the year.

NONMETALS

Cement.—Local cement consumption estimated at 3.5 million tons for the year, decreased during 1978 as demand from the construction industry slowed. At the end of August, consumption was estimated at 2,376,000 tons, down 30% for the same 1977 period. There was also a reduction in cement imports, which at the end of August were down by about 28.5%. Imports were expected to continue to decline as several new Moroccan plants came onstream. The Cimenterie de l'Oriental plant (1.2 million tons' yearly capacity) at Oujda came onstream in late 1979. The new company was to be called Cimenterie Maghrebine (CIMA). A new facility was also built for Asement de Temara S.A. near Rabat (690,000 tons' yearly capacity) with the first phase of 360,000 tons completed during the second quarter of 1979 and the final startup by 1982. The Blue Circle Group's Consultancy Services was contracted to establish the feasibility of and to construct a new million-ton cement plant at Casablanca Sud. A new 760,000-ton-per-year plant was also to be built at Fgih Bin Salah in the Tadlu area. Morocco's cement production target was 7.6 million tons by 1982.

Phosphate Rock.—Morocco's Office Cherifien des Phosphate (OCP) was proceeding ahead with plans for a major expansion of phosphate mining and processing, designed to reinforce the country's position as the world's largest exporter of phosphate rock. Several loans were secured during 1978-79 as progress continued toward this goal. In 1979, OCP negotiated a loan for $200 million from a consortium of European, Arabian, and Japanese banks, but without any specific project in mind. The World Bank approved a loan of $50 million for construction of the Maroc Phosphore II phosphate processing plant. The project was cofinanced by a loan of $13.7 million from Poland and would need an overall investment of about $124.4 million. Late in 1978, a medium-term Eurocurrency loan of $150 million was granted to OCP by a consortium of 36 international banks, led by the Banque Marocaine du Commerce Exterieur (BMCE). This loan was to finance new projects at Ben Guerir and Khouribga. Under development, the open cast mine at Benguerir was to come onstream in 1980 with a capacity of 600,000 tons per year; by 1984, it was to produce 2 million tons per year of phosphate rock at the Maroc Phosphore II plant. OCP was installing a Krupp-built impact jaw crusher at Ben Guerir, the largest of its kind in the world and capable of processing 800 tons of rock per hour. At Khouribga, Recette IV was to be developed as an open pit mine, producing 2.6 million tons of phosphate rock per year by 1981, and increasing to 3.9 million tons per year by 1982. Current production capacity of the Khouribga-Casablanca area was about 16 million tons per year with a treatment capacity of about 19 million tons per year. In 1978, 14,461,000 tons of phosphate rock was produced at Khouribga, and 4,812,000 tons was produced at Youssoufia.

OCP also obtained a $100 million loan from the international financial market for phosphate processing at Safi. It was to be used to finance equipment at the Qued Zem complex and for an extension to Maroc Phosphore I, raising the capacity to 660,000 tons of phosphoric acid. Polimex-Cekop of Poland was to have a $26.4 million contract to equip the sulfuric acid unit at Safi. The contract was a barter deal with OCP under which Poland was to import phosphate rock. In 1978, OCP's phosphoric acid capacity at Safi was 850,000 tons per year. When the fourth line of Maroc Phosphore I and the Maroc Phosphore II project are completed in 1980, this capacity will rise to 1.5 million tons per year. The European Investment Bank (EIB) was to lend Morocco $52 million for building the phosphate rock port at Jorf Lasfur, 80 kilometers south of Casablanca. A new major fertilizer complex, Maroc Phosphore III, will also be developed at Jorf Lasfur. The first stage, producing 1,500 tons per day of phosphoric acid from Khouribga phosphate, will begin in 1983. This output will be doubled to 3,000 tons per day by 1985. The first phase also includes washing and drying facilities for 3 million tons per year of phosphate rock, to be obtained from Sidi Hajjaj.

Geological studies were underway at the Meskala-Essouira phosphate deposits as well as studies for a new port at Cap. Sim. The new port was to be built after Jorf Lasfar has been completed. Much of the production from the Meskala area was destined for the Soviet Union, under a major cooperation agreement signed in 1977. Studies were continuing on the deposits at Sidi Hajjaj. The first stage of production, with a capacity of three million tons per year, was scheduled to begin in 1983.

Western Sahara.—Although shipments of phosphate rock from the Bu Craa Mine stockpiles had resumed by the fourth quarter of 1977 and continued to be delivered by heavily guarded convoy to the coast, the mine itself had not started production. The 100-kilometer conveyor belt connecting the mine to El Aaium processing facilities was also inoperative. By 1979, with exhaustion of ore stocks at the mine, all movement of phosphate rock to the coast ceased, as did exports of crude concentrate. At yearend 1979, there were no plans to resume production at the mine in the near future, despite predictions made earlier in the year that the mine would open by late 1979. The mine had been closed for nearly 4 years by Polisario guerilla action following Spain's 1975 handover of the territory to Morocco and Mauritania. Raids had been made repeatedly on the conveyor, and a total of 6 kilometers of belt had been completely burnt out at five separate sections. Two of the 10 control stations were also damaged. Germany's Krupp Industries had agreed to repair the belt after initially declining to send technicians into the troubled area. In 1978, Fosfatos de Bu Craa (Fosbucraa) expected most of the approximately 450,000 tons of concentrate produced to be exported. The first cargo of 55,000 tons for the Zen Noh Company of Japan left El Aaiun in March 1978. Sales were primarily to Spain and Japan, both established consumers of Bu Craa phosphate rock, while deliveries were also made to Germany, France, Finland, Hungary, and Lebanon.

Sulfur.—The Iranian unrest of 1978 had an indirect influence upon Morocco's supply of sulfur, affecting the fertilizer and chemical industries. Morocco imported most of its sulfur from Poland, which produced it through gas received from the Soviet Union, which in turn had its gas supply cut off from Iran. As a result, Poland's exports of sulfur to Morocco were cut back by 25%.

MINERAL FUELS

Bituminous Shale.—A wide-ranging agreement with Occidental Petroleum of the United States for cooperation in the development of the Moroccan oil shale deposits was signed in early 1979. Occidental was to develop Timadhit oil shale to produce 50,000 barrels of oil per day by an in situ process. A $30 million feasibility study was first to be carried out over a period of a year. A 60-ton oil shale shipment was sent to Laramie for testing in late 1979. Five sites had been selected by Occidental for in situ test retorting. A Soviet-supported, oil-shale-fired, electric power facility was also planned for completion by 1985. In 1978, studies by three firms (Deutsche Babcock and Klockner of Germany and Energomashexport, U.S.S.R.) established the shale to be characterized by self-sustaining combustion. An ash content of 70% and a low heat capacity raised questions as to the economic viability of the deposits.

Coal.—An estimated 44.5 million tons of lignite was discovered at Oued Nja as a result of the Moroccan Bureau de Recherches & de Participations 1977 exploration program. Charbonnages Nord-Africaines (CNA) increased their capacity and market for coal by 6% per year during the period 1973-77. With the opening of a new pit (No. 5) at the anthracite deposits of Jerada, CNA further increased production by about 2% in 1978. Anthracite-fueled electric plants furnished about 32% of the national energy needs. Prospecting for new reserves continued at Jerada.

Natural Gas.—Gas production from the Essaouira basin and from Mechra bel Ksiri in the Rhaarb basin increased, while Douar production declined. Average gas output in 1978 was about 7.9 million cubic feet per day, compared with 8.3 million cubic feet per day in 1977.

Petroleum.—In an attempt to reduce dependence on petroleum imports, there has been an increase in oil exploration. The BRPM was spending more on petroleum research than on prospecting for other mineral resources. Seven agreements for petroleum exploration had been signed in 1978 and 1979, two on land and five offshore. A consortium that included Phillips Petroleum Co., the Italian company AGIP, British Petroleum (BP), and Getty Oil, working with BRPM, was operating off Essaouira, while BP and Phillips held permits off El Aaiun. In 1978, Phillips signed an agreement with BRPM to prospect for oil in the Guercif and Missour areas, where BRPM had already completed geological and geophysical surveys. Occidental Petroleum signed a petroleum exploration contract on September 14, 1979. The accord was for an area west of Agadir and the Souss. An agreement was also signed with Elf Aquitaine Morocco Corporation for offshore exploration and exploitation of discoveries made at Fes and Taza and of a deposit of natural gas in the same region.[4] Discovery of oil in the Taza region was announced in late 1978 in the Raob Basin, northeast of Rabat. The U.S. National Science Foundation was reported to have found evidence of a major oilfield off the coast of northwest Africa, in samples obtained from 5,000-foot drillholes in 12,000 feet of water with the

Glomar Challenger ship, 90 miles off Cape Tafelney.

The Société Nationale des Produits Pétroliers (SNPP) reported the domestic products market experienced a demand increase of 8.5% in 1978, the same rate as in 1977. The needs of the market were supplied 74% by local refineries; the remainder was imported in the form of refined petroleum products. This situation changed in 1979 when the expansion of the Société Anonyme Marocaine de l'Industries du Raffinage (SAMIR) refinery was completed. The refining potential of 80,000 barrels per day was expected to be sufficient to supply over 90% of the country's needs. Morocco received a $35 million loan from a consortium of Arab and foreign banks to expand the oil refinery, located near Mohammedia, about 12 miles south of Casablanca. Oil imports had been growing at the rate of 10.2% per year between 1970 and 1976.[5]

Nuclear Energy.—Morocco was to buy a nuclear reactor (100-kilowatt capacity) from the U.S. firm General Atomic. The reactor was to be used in the Atomic Studies Institute of Rabat, which opened at the end of 1978 to permit training and research for the technicians who will supervise the future thermonuclear station in Morocco.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Moroccan dirhams (DH) to U.S. dollars at the rate of DH4.0 = US$1.00 for 1978 and DH3.75 = US$1.00 for 1979.

[3] U.S. Embassy, Rabat, Morocco. Economic Trade Report. State Department Airgram A-17, Mar. 16, 1979, p. 10.

[4] Industries et Travaux D'Outremer. Afrique du Nord (North Africa). V. 26, No. 300, November 1978, p. 891.

[5] Petroleum Economist. Energy and the Oil Importing Developing Countries (OIDCS). V. 46, No. 10, October 1979, p. 426.

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The Mineral Industry of Mozambique

By Miller W. Ellis[1]

Mozambique's mineral industry has left an incomplete record since the Government of the People's Republic of Mozambique (GPRM) became independant from Portugal in 1975. Because most of the expatriate population had departed before the new government took over, it was necessary to call on technical experts from the Eastern European countries to set up new governmental departments. These officials were expected to supervise research work, to train all staff, and to produce mineral commodities. The economic directives of the third Frelimo Party Congress of February 1977 contained regulations intended to insure that the economic community would not stagnate. Property left for 90 days reverted to the state without compensation. Businesses were taken over by the workers or operated by a state-appointed administrative committee. Basic commodities were procured and distributed by state agencies which replaced retail shops in some areas. Major industries were supervised by the Council of Ministers, and most of the banks were nationalized with compensation promised, as were the larger mines and the oil refinery. The nationalization of a Mozambican firm producing galvanized roofing and pipe, and of four mining companies including a potential fluorspar producer, was announced in August 1979. The Mozambique Glass Company, which operated in the Matola industrial district of Maputo and had recently installed a new furnace, was nationalized in October 1979.

In 1978 the Republic of South Africa finally abandoned its fixed price per troy ounce for gold (equal to $42) in favor of the world market price. This substantially reduced the amount of gold paid to Mozambique and other neighboring countries as deferred wages and benefits for their emigrant nationals employed in South Africa's mines. Mozambique's loss of revenue was estimated at about $100 million. In 1977 Mozambique's chief port of Maputo (formerly Lourenço Marques) handled nearly 12 million tons of export freight of which 6 million tons were from the Republic of South Africa. In mid-1978 the GPRM negotiated an agreement providing for the Republic to double its exports through Maputo by 1985. In order to provide increased facilities Mozambique borrowed a number of South African Railway's locomotives, arranged to purchase other locomotives as well as forklift trucks, and was to build a second coal loading facility to handle the output of a new mine in the northern Transvaal. The railroad on both sides of the border was equipped with centralized traffic controls, heavier rail, and additional ballast in order to carry two to three times the amount of freight to Maputo.

A 35-member delegation from the German Democratic Republic arrived in Mozambique on July 4, 1978, and subsequently signed agreements to assist with mineral exploration, supervise coal and metal mining, and build textile and truck factories and high-tension powerlines. They undertook to provide technical assistance in toolmaking, metallurgy, agriculture, and fishing, and to train Mozambicans technically.

In July 1979 a Mozambican trade delegation visited Brazil to cement economic ties between the two countries, and to negotiate with Petróleo Brasileiro S.A. (PETROBRAS) for petroleum research in Mozambique. The following month a large delegation from Siderúrgica Brasileira S.A. (SIDERBRAS) commenced investigating the use of

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Brasilian technology in the extraction of Mozambique's iron ore reserves for Brazil's iron industry.

During a 5-day visit to Iraq in December 1979, Mozambique's head of state signed a joint communique in which Iraq pledged to compensate Mozambique, as a poor developing country that has a petroleum contract with Iraq, by granting a long-term interest-free loan equal to the surcharges on petroleum imposed from June 1979 to the end of the year.

PRODUCTION AND TRADE

Mozambique's deteriorating economic situation reflected its unbalanced trade as shown by its soaring imports. Among the sparse statistics available were those in the following table:

Balance of payments estimates

(In millions of United States dollars)

	1975	1976	1977	1978	1979[e]
A. Merchandise trade:					
Imports	295	396	495	528	660
Exports	169	147	150	176	241
Balance	-126	-249	-345	-352	-419
B. Invisible items:					
Payments	92	96	90	83	NA
Receipts[1]	255	243	200	216	NA
Balance	+163	+147	+110	+133	+231
Current balance	+37	-102	-235	-219	-188
Overall balance	-25	-154	-185	-239	NA

[e] Estimated. NA Not available.

[1] Includes foreign assistance.

Source: Government of Mozambique, quoted in United Nations General Assembly. Report of the Economic and Social Council, August 16, 1979.

In 1979 the GPRM appeared to be seeking more trade and investment from the West, including the Republic of South Africa. South African contractors were hired to expand the coal loading facility at Maputo. It was claimed that 85% of Maputo's export traffic originated in the Republic and generated $12 million per year in transit fees for Mozambique.

The Republic of South Africa continued to purchase the 1,200-megawatt output of the Cabora Bassa dam on the Zambezi River at a cost estimated at $4 million per month in 1978 but increasing to about twice that by the end of 1979. The funds were paid to Hidro-electrice de Cabora Bassa (HCB), which was controlled 85% by Portuguese and 15% by Mozambique interests and was responsible for paying off the outstanding European and South African creditors. By 1992 all such debts should be repaid and the ownership of the installation and all foreign exchange income accruing to it will belong to the GPRM.

Table 1.—Mozambique: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum: Bauxite, gross weight	2,000	2,000	--	--
Beryllium: Beryl concentrate, gross weight	(3)	NA	NA	NA
Columbium and tantalum ores and concentrates, gross weight:				
Columbite[e] kilograms	1,700	2,300	2,300	2,300
Microlite do	55,921	39,866	39,866	31,750
Tantalite[e] do	28,000	36,300	36,300	31,750
Copper, mine output, salable ore and concentrate:				
Gross weight	--	--	460	400
Metal content	--	--	130	100

See footnotes at end of table.

Table 1.—Mozambique: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
NONMETALS				
Cement, hydraulic thousand tons	217	323	[e]327	[3]273
Clays:				
Bentonite (including montmorillonite)	2,298	2,744	3,000	3,000
Kaolin (including china clay):				
Crude	(4)	--	--	--
Washed	(4)	--	--	--
Feldspar[e]	850	900	900	900
Gem and ornamental stones:				
Beryl crystals kilograms	32	14	15	[3]1,920
Garnet do	2,360	1,871	2,000	[3]11,200
Tourmaline do	25	26	25	25
Lime, hydraulic	[r] [e]100,000	[e]100,000	10,000	10,000
Lithium minerals:[e]				
Lepidolite	730	--	--	--
Spodumene	25	--	--	--
Mica, mainly scrap[e]	900	800	900	900
Salt:				
Marine	28,000	28,000	28,000	28,000
Rock[e]	(4)	--	--	--
Sulfuric acid	15,300	18,750	NA	NA
MINERAL FUELS AND RELATED MATERIALS				
Coal, bituminous thousand tons	553	310	118	[3]320
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	473	621	510	NA
Kerosine do	195	178		
Jet fuel do	56	128	296	NA
Distillate fuel oil do	613	865	634	NA
Residual fuel oil do	1,003	1,438	1,132	NA
Other do	167	63	85	NA
Refinery fuel and losses do	278	299	270	NA
Total do	2,785	3,592	2,927	NA

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1]In addition to the commodities listed, crude construction materials and additional varieties of gem and ornamental stones presumably are produced, chiefly for local consumption, but information is inadequate to make reliable estimates of output levels.

[2]Less than 1/2 unit.

[3]Reported figure.

[4]Revised to none.

COMMODITY REVIEW

METALS

Copper.—Early in 1978 the GPRM reactivated Lonrho's Edmundian copper mine near Manica, across the border from Umtali, Rhodesia-Zimbabwe. A loan of $600,000 from the Bank of Mozambique paid wages for a staff of 298 and purchased necessary supplies. In January 1978, 460 tons of chalcopyrite concentrate with about 130 tons copper content was sold to the German Democratic Republic (GDR). At a nearby mine, 28 miners were producing an average of 6.4 ounces of gold per month.

The Soviet Union and the GPRM signed an agreement in March 1978 authorizing the Soviet Enterprise Techniexport to make a 3-year study of the mineral resources in the Tete, Nampula, and Zambezia districts, involving some 60 Soviet experts with $500,000 worth of research equipment. Studies of bauxite, coal, copper, nickel, gold, pegmatite, and syenite deposits were scheduled to start in October 1978.

The Secretary of the German Democratic Republic State Ministry of Geology also signed an accord on June 22, 1978, for supplying German Democratic Republic technicians to operate copper and gold mines in the Manica district. Subsequently the delegation of July 4, 1978, signed an agreement covering mineral exploration in the Manica and Zambezia districts, but details of the Manica copper-gold projects were not revealed.

Iron and Steel.—At the request of the GPRM, the Swedish Aid Authority was investigating the iron ores of the Honde area in central Mozambique as the basis for a domestic iron and steel industry. Production of Mozambique's Cifel steel foundry increased in 1978, but the industry was plagued by shortages of skilled workers.

MINERAL FUELS

Coal.—On May 12, 1978, the GPRM nationalized the country's only coal mine at Moatize and its owner, Companhia Carbonifera de Mozambique (CCM), because of the lack of safety precautions and in order for GPRM to control this key sector of the economy. Frelimo Congress Law established that mineral rights and subsoil were state property and no indemnification was required therefore. The law also provided that other terms for indemnification may be set at a future date if not nullified by the behavior of the former owners toward the state, the mine property, and/or its records. The Portuguese-Mozambican group Enterposto owned 46% of CCM, ISCOR of South Africa reportedly owned 26%, and 5% was state controlled. Mining operations were restarted in May 1978 under the direction of technicians from Romania and the German Democratic Republic. CCM employees were absorbed into the new Mozambican National Coal Company known as Carbomoc. An accord confirming East German assistance for the Moatize coal mine in Tete Province was signed on June 22, 1978, and a 35-member delegation led by the German Democratic Republic Minister of Coal and Energy arrived on July 4, 1978, and signed new agreements to provide men and equipment to operate the Moatize colliery, and to export part of the product to the German Democratic Republic. In April 1979 the GDR revealed that the GPRM had overestimated the amount of high-grade coal at Moatize, and the production schedule of 2.5 million tons for 1980 was judged too high.

Petroleum.—Empresa Nacional Petróleos de Mozambique's (Petromac's) major facility in the Matola industrial district of Maputo continued as the country's only petroleum refinery. The staff of 600, including Romanian technicians, failed to achieve Petromac's production goal of 570,000 tons throughput for 1978, but had planned to increase throughput and to export refined products in 1979. The company acquired a 10,000-ton oil tanker in May 1978 and named it the Matchedje. The 5-year old ship, reportedly of Japanese origin, was scheduled to haul fuel to Mozambique ports and to earn foreign exchange by carrying international freight.

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[1] Physical scientist, Branch of Foreign Data.

The Mineral Industry of the Netherlands

By William F. Keyes[1]

The Dutch economy was again one of Europe's stronger economies during 1978 and 1979, but it was linked more closely than ever before to foreign trade, rather than to domestic growth. In June 1978, the Dutch Government introduced Economic Blueprint 1981, which established a framework for balanced economic growth into the 1980's. The central conclusion was that Government spending during the past decade was beginning to adversely affect the country's economic health, and the Blueprint called for a reduction of 10 billion guilders[2] in planned budget increases during the 1979-81 period. The Blueprint focused on four goals: reduction of unemployment to 150,000 workers (3.8%), a drop in inflation, a reduction in labor income by 1% annually, and maintenance of purchasing power and social benefits for the average worker. These proposals evoked considerable discussion, and in 1979, there was some realignment of priorities in order to favor lower income groups. One major criticism was that the Blueprint failed to call for restructuring the economy toward high technology, which will be essential after 1985 when foreign natural gas sales are expected to begin to decline.

The major mineral resource of the Netherlands is its large onshore reserves of natural gas, and a key element in the Government's economic policy has been to prepare for eventual depletion of these reserves. Steps taken by the Government have included the initiation of gas imports and preparations for greater use of imported coal and nuclear power. A decline in natural gas exports and a rise in imports converted the 1-billion-guilder current account surplus of 1977 to a half-billion-guilder deficit in 1978, but a 0.6-billion-guilder surplus was registered in the first 7 months of 1979. In other areas of the minerals and metals sector, the country's major steelmaker had a profitable period, but still faced declining world markets, upon which it is dependent; and the large petroleum refining industry operated at well below capacity while also facing a decline in vital export markets.

PRODUCTION

The heavy industry production index rose slightly between 1977 and 1978 (1970=100), from 127 to 128, and continued on a moderate increase in 1979, but the minerals production index declined from 213 in 1977 to 196 in 1978. The two major components of the minerals production index were the natural gas index, which declined from 292 to 267 in the same period, and the index of other minerals, which declined from 93 to 92. Production of minerals in recent years is given in table 1.

Table 1.—Netherlands: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]		1976	1977	1978[p]	1979[e]
METALS					
Aluminum metal, primary		255,504	241,269	261,164	255,500
Cadmium metal		397	302	402	400
Iron and steel:					
Sintered ore (from imported ore)	thousand tons	2,582	2,709	3,012	2,900
Pig iron, including blast-furnace ferroalloys	do.	4,265	3,922	4,613	[2]4,813
Crude steel	do.	5,189	4,927	5,590	5,806
Semimanufactures	do.	4,530	4,251	4,732	NA
Lead metal, smelter:					
Primary		21,890	21,132	18,172	20,000
Secondary		14,800	12,700	13,700	9,000
Total		36,690	33,832	31,872	29,000
Tin metal:[e]					
Primary		2,000	2,100	1,800	2,000
Secondary		180	180	180	180
Zinc metal, primary		140,807	109,398	135,300	154,000
NONMETALS					
Cement, hydraulic	thousand tons	3,481	3,895	3,918	3,710
Nitrogen: N content of ammonia	do.	1,980	2,140	2,166	2,200
Peat	do.	400	400	400	400
Salt, all types	do.	3,026	3,111	2,939	2,900
Sand, industrial	do.	24,400	25,600	23,500	NA
Sodium compounds:					
Sodium carbonate	do.	271	276	280	280
Sodium sulfate, synthetic	do.	50	50	50	50
Sulfur:					
Elemental byproduct:					
Of metallurgy	do.	85	64	60	60
Of petroleum	do.	65	64	65	65
Total	do.	150	128	125	125
Sulfuric acid, 100% H_2SO_4	do.	1,402	1,572	1,680	1,800
MINERAL FUELS AND RELATED MATERIALS					
Carbon black		90,000	90,700	86,800	93,000
Coke	thousand tons	2,813	2,501	2,401	2,500
Gas:					
Manufactured, all types[3]	million cubic feet	[r]259,403	218,942	264,531	267,000
Natural:					
Gross	do.	3,486,171	3,421,940	3,133,456	[2]3,306,709
Marketed	do.	NA	NA	NA	[2]3,291,947
Petroleum:					
Crude	thousand 42-gallon barrels	9,345	9,420	9,556	8,970
Refinery products:					
Gasoline:					
Aviation	do.	1,228	1,095	1,157	[2]307
Motor	do.	59,118	54,460	60,588	[2]63,346
Jet fuel	do.	23,888	24,320	21,728	[2]23,040
Kerosine	do.	5,193	4,487	3,860	[2]4,270
Distillate fuel oil	do.	134,496	133,974	139,726	[2]148,081
Residual fuel oil	do.	144,395	131,868	124,475	[2]121,319
Lubricants	do.	6,601	3,892	4,200	[2]3,965
Bitumen	do.	6,260	5,660	(4)	[2]5,563
Liquefied petroleum gas	do.	12,203	11,832	(4)	[2]13,097
Other	do.	71,409	57,574	53,363	[2]44,308
Refinery fuel and losses	do.	25,592	18,943	17,807	[2]23,064
Total	do.	490,383	448,105	426,904	463,432

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities listed, a variety of crude construction materials (clays, stone, and gravel) presumably is also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

[3] Coke oven and blast furnace gas only.

[4] Included with "Other."

TRADE

The Netherlands lives by trade; its merchandise exports equal two-fifths of the total gross national product. It imports large quantities of raw materials, including all energy sources except natural gas and some petroleum, and reexports the processed forms of many of these to its major customers. The Netherlands' customers are chiefly other members of the European community, and the greatest share of Dutch exports is purchased by the Federal Republic of Germany. The United States and the Netherlands are major trading partners and are also currently the largest direct foreign investors in each other's territory. Leading U.S. minerals exports to the Netherlands are nonferrous metals, coal, and petroleum coke. The United States imports from the Netherlands important quantities of petroleum products, iron and steel semimanufactures, copper metal, and diamonds. Minerals trade between the two countries is almost balanced at about half a billion dollars each way. The Netherlands' minerals trade is reported in tables 2 and 3.

Table 2.—Netherlands: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Ash and residue	8,765	6,089	West Germany 4,476; France 1,555.
Bauxite	3,467	3,295	West Germany 1,148; Sweden 869; Belgium-Luxembourg 628.
Oxide and hydroxide	30,638	39,964	West Germany 11,733; France 6,329; Italy 5,121.
Metal including alloys:			
Scrap	53,358	61,994	West Germany 47,008; France 8,730.
Unwrought	316,247	294,443	Belgium-Luxembourg 125,741; France 76,668; West Germany 60,054.
Semimanufactures	81,100	80,433	West Germany 33,977; Belgium-Luxembourg 13,881; France 11,313.
Antimony:			
Metal including alloys, all forms	91	39	France 12.
Oxide	188	407	West Germany 340.
Arsenic oxide and acid	39	--	
Bismuth metal including alloys, all forms	46	66	France 41; United States 15.
Cadmium metal including alloys, all forms	380	373	United States 129; France 96; United Kingdom 79.
Chromium:			
Chromite	^{r}19,548	15,150	West Germany 8,481; France 4,929; Switzerland 993.
Oxide and hydroxide	41	361	United Kingdom 270.
Cobalt:			
Oxide and hydroxide	26	62	West Germany 56.
Metal including alloys, all forms	95	100	United States 28; United Kingdom 17; Austria 13.
Columbium and tantalum metals including alloys, all forms	7	8	NA.
Copper:			
Ash and residue	5,972	4,428	West Germany 2,321; Belgium-Luxembourg 1,495.
Metal including alloys:			
Scrap	35,371	41,509	West Germany 21,974; Belgium-Luxembourg 14,037.
Unwrought	5,256	4,533	West Germany 2,068; Belgium-Luxembourg 1,133.
Semimanufactures	45,014	53,456	United States 12,768; West Germany 11,996; France 5,655.
Germanium metal including alloys, all forms	--	1	All to Belgium-Luxembourg.
Gold thousand troy ounces	727	850	Switzerland 380.
Iron and steel:			
Ore and concentrate, except roasted pyrite	147,631	11,671	West Germany 6,572; France 1,811; Italy 1,442.
Metal:			
Scrap thousand tons	926	1,190	West Germany 700; Belgium-Luxembourg 231; Spain 109.
Pig iron and ferroalloys[1]	17,464	16,637	Germany 9,887; France 5,114.
Steel, primary forms thousand tons	1,539	1,708	West Germany 486; United States 306; United Kingdom 134.
Semimanufactures:			
Bars, rods, angles, shapes, sections	465,029	537,501	Belgium-Luxembourg 109,369; West Germany 100,215; United Kingdom 40,679.
Universals, plates, sheets thousand tons	1,628	1,625	United Kingdom 284; United States 257; West Germany 217.

See footnotes at end of table.

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Table 2.—Netherlands: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Semimanufactures —Continued			
Hoop and strip	97,903	119,052	West Germany 75,307; Switzerland 10,177; Belgium-Luxembourg 6,586.
Rails and accessories	30,619	39,702	West Germany 21,184; Italy 7,781; Pakistan 4,988.
Wire	53,667	54,665	France 14,973; West Germany 11,108; Belgium-Luxembourg 9,646.
Tubes, pipes, fittings	334,362	553,138	West Germany 117,097; Venezuela 84,744; Belgium-Luxembourg 44,030.
Castings and forgings, rough	9,255	12,450	Belgium-Luxembourg 6,763; West Germany 4,240.
Lead:			
Ash and residue	4,179	3,945	Belgium-Luxembourg 2,893.
Oxides	578	3,841	Italy 2,967.
Metal:			
Scrap	39,874	32,825	West Germany 12,817; Demark 8,801.
Unwrought	14,958	21,722	West Germany 12,725; Belgium-Luxembourg 2,020; U.S.S.R. 2,398.
Semimanufactures	1,622	2,213	Belgium-Luxembourg 759; Norway 108.
Magnesium metal including alloys:			
Scrap	1,972	1,687	United States 1,165.
Unwrought and semimanufactures	r2,589	4,590	West Germany 2,815; United Kingdom 1,193.
Manganese:			
Ore and concentrate	31,557	37,452	West Germany 7,157; Belgium-Luxembourg 4,213; Iran 4,067.
Oxide	51	8	NA.
Mercury 76-pound flasks	1,856	1,903	West Germany 836; Indonesia 129; Belgium-Luxembourg 129.
Molybdenum:			
Oxide	1,609	1,621	Austria 1,079.
Metal including alloys, all forms	187	153	Belgium-Luxembourg 101; West Germany 18.
Nickel:			
Matte, speiss, similar materials	681	2,568	West Germany 1,478; France 329; Sweden 286; India 231.
Oxide and hydroxide	137	273	West Germany 66; France 55; Sweden 53.
Metal including alloys:			
Scrap	1,795	1,845	West Germany 602; United Kingdom 434; Sweden 241.
Unwrought	1,968	3,246	United Kingdom 1,895.
Semimanufactures	2,680	338	Sweden 111; West Germany 65; Spain 23.
Platinum-group metals, all forms thousand troy ounces	r46,607	37,843	Switzerland 6,471; United States 3,962; Japan 3,904.
Selenium, elemental	37	6	France 3; Poland 2.
Silver metal including alloys, all forms thousand troy ounces	15,868	892,703	West Germany 489,846; France 125,056.
Tellurium, elemental and arsenic	27	17	France 16.
Tin:			
Oxide	6	--	
Metal including alloys:			
Scrap	698	549	United Kingdom 320; West Germany 174.
Unwrought	1,758	1,274	West Germany 618; United Kingdom 472.
Semimanufactures	692	691	West Germany 365; Belgium-Luxembourg 108; Spain 34.
Titanium:			
Ore and concentrate (ilmenite)	10,460	940	Norway 514; Belgium-Luxembourg 100.
Oxides	24,444	10,228	West Germany 1,638; France 1,755.
Metal including alloys, all forms	109	135	Italy 72; United Kingdom 35.
Tungsten:			
Ore and concentrate	864	1,260	West Germany 559; Czechoslovakia 291; U.S.S.R. 258.
Metal including alloys, all forms	220	243	Belgium-Luxembourg 114.
Zinc:			
Ash and residue	10,679	12,887	West Germany 4,171; Belgium-Luxembourg 3,953; France 2,362.
Ore and concentrate	15,142	3,200	Belgium-Luxembourg 2,109; Italy 1,066.
Oxide	7,829	10,484	Belgium-Luxembourg 1,730; West Germany 1,607.
Metal including alloys:			
Scrap	6,053	6,352	France 2,664; Belgium-Luxembourg 1,807; West Germany 1,023.
Dust (blue powder)	1,979	2,821	NA.
Unwrought	109,219	123,205	United Kingdom 49,958; West Germany 27,329; France 12,508.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Zinc —Continued			
Metal including alloys —Continued			
Semimanufactures	3,449	5,615	West Germany 3,300; Belgium-Luxembourg 630; Switzerland 374.
Zirconium ore and concentrate	17,311	839	West Germany 512; France 168.
Other:			
Ores and concentrates	22,350	24,265	Italy 4,711; United Kingdom 4,451; West Germany 4,422.
Base metals including alloys, all forms	2,859	3,542	West Germany 2,532; France 334; United Kingdom 202.
Ash and residue containing nonferrous metals	6,260	9,663	West Germany 3,716; Belgium-Luxembourg 2,729; United Kingdom 1,297.
Oxides, hydroxides, peroxides of metals	442	130	NA.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	8,027	7,835	Norway 1,606; Thailand 1,268; United Kingdom 973.
Dust and powder of precious and semiprecious stones, including diamond thousand carats	1,089	1,026	United Kingdom 524; West Germany 113; Belgium-Luxembourg 107.
Grinding and polishing stones	3,218	3,357	West Germany 790; United Kingdom 765; Australia 188.
Asbestos	255	393	West Germany 258.
Barite and witherite	103,708	94,774	United Kingdom 60,976; Norway 17,140; West Germany 13,993.
Borates, crude, natural	341.025	338,960	West Germany 80,078; France 65,017; United Kingdom 48,947.
Cement	335,247	412,319	West Germany 159,800; Belgium-Luxembourg 142,676.
Chalk	17,332	29,886	All to Belgium-Luxembourg.
Clays and clay products:			
Crude:			
Bentonite	17,107	23,839	Belgium-Luxembourg 11,034; France 3,421; United Kingdom 3,206.
Kaolin	71,194	84,085	Belgium-Luxembourg 73,436; West Germany 7,023.
Refractory	3,386	3,372	West Germany 2,100; Belgium-Luxembourg 904.
Other	1,098	1,060	West Germany 334; Nigeria 252; Belgium-Luxembourg 187.
Products:			
Refractory (including nonclay brick)	32,189	24,979	West Germany 8,952; Belgium-Luxembourg 3,097; France 2,697.
Nonrefractory	736,402	756,645	West Germany 539,084; Belgium-Luxembourg 172,248; France 19,089.
Diamond, excluding dust and powder:			
Worked:			
Gem carats	443,663	599,552	Belgium-Luxembourg 326,208; United States 106,438.
Industrial do	33,201	6,753	United States 5,995.
Unworked:			
Gem thousand carats	626	249	Israel 147; Belgium-Luxembourg 49; United States 32.
Industrial do	4,152	1,065	United States 252; Belgium-Luxembourg 208; Israel 130.
Unsorted do	1,832	1,085	Israel 476; Belgium-Luxembourg 182; United Kingdom 179.
Diatomite and other infusorial earth	294	520	Belgium-Luxembourg 226.
Feldspar, fluorspar, leucite	3,135	6,441	West Germany 2,324; Belgium-Luxembourg 1,909; Finland 1,208.
Fertilizer materials:			
Crude:			
Phosphatic	75,915	66,605	West Germany 62,961; Ireland 2,407.
Other	96,281	78,167	Belgium-Luxembourg 61,526; West Germany 14,681.
Manufactured:			
Nitrogenous thousand tons	2,588	3,089	United States 672; India 633; Brazil 440.
Phosphatic (including Thomas slag)	186,616	236,734	West Germany; 9,003; France 117,725; Belgium-Luxembourg 38,947.
Potassic (K_2O content)	518	487	Belgium-Luxembourg 200; Oman 130; Nigeria 79.
Other, including mixed	985,853	952,517	France 363,973; United Kingdom 94,213; West Germany 88,178.
Ammonia, anhydrous thousand tons	720	698	Belgium-Luxembourg 291; Ireland 109; United Kingdom 101.
Graphite, natural	191	594	West Germany 530.
Gypsum and plasters	1,902	2,366	Belgium-Luxembourg 797; United Kingdom 473.

See footnotes at end of table.

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Table 2.—Netherlands: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Lime	3,431	4,711	West Germany 2,460; Saudi Arabia 1,249.
Magnesite	29,981	33,554	West Germany 17,109; France 5,560.
Meerschaum, amber, jet	2	--	
Mica	831	713	Oman 225; West Germany 213.
Pigments, mineral, including processed iron oxides	3,464	4,648	West Germany 2,485; United Kingdom 614; France 548.
Precious and semiprecious stones, except diamonds kilograms	2,633	3,771	West Germany 3,557; Belgium-Luxembourg 143.
Salt thousand tons	1,988	1,891	Belgium-Luxembourg 514; West Germany 510; Sweden 375.
Stone, sand and gravel:			
Dimension stone:			
Unworked and partly worked	4,614	4,318	West Germany 3,015.
Worked	6,033	11,984	West Germany 8,734; Belgium-Luxembourg 2,592.
Dolomite	11,527	10,463	West Germany 7,627; Belgium-Luxembourg 1,269.
Gravel and crushed stone thousand tons	^{r}4,088	3,226	Belgium-Luxembourg 2,921; West Germany 302.
Limestone	371	23	NA.
Quartz and quartzite	9,943	11,395	West Germany 8,259; Belgium-Luxembourg 1,702.
Sand, excluding metal bearing thousand tons	9,553	8,767	Belgium-Luxembourg 8,360.
Sulfur:			
Elemental	17	57	Belgium-Luxembourg 54.
Sulfur dioxide	1,378	--	
Sulfuric acid	156,944	156,981	Belgium-Luxembourg 37,326; Spain 37,100; Portugal 21,734.
Talc and steatite	2,785	3,674	Belgium-Luxembourg 847; Saudi Arabia 718; Italy 608.
Other:			
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture thousand tons	^{r}56	36	West Germany 23; Belgium-Luxembourg 6.
Other do	74	78	Belgium-Luxembourg 34; West Germany 8.
Unspecified do	187	--	
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	48	51	NA.
Carbon black	84,454	72,555	France 35,463; West Germany 16,065; Belgium-Luxembourg 9,916.
Coal and briquets:			
Anthracite and bituminous coal	462,415	485,013	Luxembourg 241,304; West Germany 227,679.
Briquets of anthracite and bituminous coal	13,093	3,376	Belgium-Luxembourg 3,164.
Lignite and lignite briquets	1,279	1,452	All to Belgium-Luxembourg.
Coke and semicoke	726,521	731,593	Belgium-Luxembourg 275,929; United States 157,683.
Peat, including peat briquets and litter	112,592	123,689	Belgium-Luxembourg 67,144; West Germany 26,888.
Gas:			
Manufactured	289	220	Belgium-Luxembourg 171; West Germany 38.
Natural million cubic feet	1,999	1,840	West Germany 852; France 372; Belgium-Luxembourg 360.
Hydrogen, helium, rare gases	^{r}23,235	24,225	West Germany 11,589; Belgium-Luxembourg 7,132.
Petroleum:[3]			
Refinery products:			
Gasoline thousand 42-gallon barrels	73,244	67,905	West Germany 41,560; United Kingdom 8,433.
Kerosine do	23,010	20,632	West Germany 10,739;United Kingdom 2,319; Denmark 2,181.
Distillate fuel oil do	105,074	100,941	West Germany 63,408; Belgium-Luxembourg 11,071; Denmark 5,256.
Residual fuel oil do	122,744	106,267	West Germany 16,520; United Kingdom 12,995; Luxembourg 9,437.
Lubricants do	3,898	4,331	Belgium-Luxembourg 804; United Kingdom 517; West Germany 353.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum[2] —Continued			
Refinery products —Continued			
Other:			
Liquefied petroleum gas thousand 42-gallon barrels	4,212	3,048	Belgium-Luxembourg 1,786; Portugal 435; West Germany 217.
Mineral jelly and wax do	[r]763	740	West Germany 256; United Kingdom 218; Morocco 48.
Petroleum coke and pitch do	2,330	2,179	West Germany 667; Denmark 485; Norway 389.
Bituminous mixtures do	385	443	West Germany 119; Nigeria 116; Sweden 75.
Unspecified do	2,104	3,253	West Germany 930; Denmark 618; Belgium-Luxembourg 287.
Total do	[r]337,814	309,739	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	445,940	543,669	West Germany 253,268; United Kingdom 113,241; Belgium-Luxembourg 54,859.

[r] Revised. NA Not available.

[1] Includes spiegeleisen, sponge iron, shot, grit, pellets, and ferromanganese.

[2] Includes bunkers.

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Table 3.—Netherlands: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite	141,242	151,521	Greece 148,250; Guyana 2,813.
Alumina	536,564	570,330	Surinam 208,378; Greece 197,269; France 126,915.
Metal including alloys:			
Scrap	29,850	30,515	West Germany 15,629; Belgium-Luxembourg 4,202; United States 2,400.
Unwrought	162,304	145,508	Norway 74,161; West Germany 43,942.
Semimanufactures	92,230	93,683	West Germany 38,683; Belgium-Luxembourg 18,643; France 11,861.
Antimony:			
Oxide	897	1,059	Belgium-Luxembourg 360; Bolivia 298; United Kingdom 249.
Metal including alloys, all forms	128	126	China, mainland, 32; Turkey 20.
Arsenic oxide and acid	200	--	
Beryllium metal including alloys, all forms	3	3	All from West Germany.
Bismuth metal including alloys, all forms	55	52	Belgium-Luxembourg; Japan 8; Mexico 8.
Cadmium metal including alloys, all forms	59	55	Japan 31.
Chromium:			
Chromite	26,440	6,398	Mozambique 5,668.
Oxide and hydroxide	608	784	West Germany 454; U.S.S.R. 244.
Metal including alloys, all forms	75	81	Japan 35; France 27.
Cobalt:			
Oxide and hydroxide	274	287	Belgium-Luxembourg 204; United States 119.
Metal including alloys, all forms	17	78	West Germany 39; United States 16.
Columbium and tantalum	2	3	NA.
Copper:			
Copper sulfate	3,479	4,603	Belgium-Luxembourg 2,154; France 1,299; U.S.S.R. 918.
Oxide and hydroxide	882	884	West Germany 520; Norway 163.
Metal including alloys:			
Scrap	14,588	7,580	West Germany 3,668; France 1,318; United Kingdom 1,258.
Unwrought	52,309	28,021	Poland 5,905; U.S.S.R. 5,176; West Germany 4,388.
Semimanufactures	87,802	91,628	West Germany 38,552; Belgium-Luxembourg 33,207; France 7,283.
Germanium metal including alloys, all forms	([1])	1	All from West Germany.
Gold[2] thousand troy ounces	754	1,148	United States 411; United Kingdom 282; Switzerland 160.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	6,921	5,578	Brazil 1,768; Liberia 865; Canada 773.
Metal:			
Scrap	113,035	166,359	Belgium-Luxembourg 77,979; West Germany 39,658; United Kingdom 28,326.
Pig iron[3]	^{r}49,309	50,805	Brazil 15,264; West Germany 13,815; France 6,579.
Ferroalloys	48,643	48,771	Norway 17,596; France 11,099; West Germany 5,622.
Steel, primary forms	290,870	292,384	Norway 128,240; Spain 77,147; West Germany 36,988.
Semimanufactures:			
Bars, rods, angles, shapes, sections thousand tons	1,309	1,332	West Germany 487; Belgium-Luxembourg 459; France 113.
Universals, plates, sheets do	1,060	1,024	Belgium-Luxembourg 392; West Germany 374; Japan 69.
Hoop and strip	196,977	193,307	West Germany 136,236; Belgium-Luxembourg 32,301; France 11,633.
Rails and accessories	38,914	45,660	West Germany 25,694; France 16,221.
Wire	110,497	107,642	Belgium-Luxembourg 57,112; West Germany 38,730; France 6,087.
Tubes, pipes, fittings	572,792	749,007	West Germany 490,977; France 121,846; Belgium-Luxembourg 43,455.
Castings and forgings, rough	15,103	18,652	West Germany 9,435; Belgium-Luxembourg 6,902.
Lead:			
Oxide	9,922	8,513	West Germany 5,768; Belgium-Luxembourg 2,581.
Ash and residue	^{r}2,755	3,157	West Germany 1,797; United Kingdom 426.
Metal including alloys:			
Scrap	16,706	10,882	West Germany 6,726; Belgium-Luxembourg 1,777.
Unwrought	^{r}60,685	59,918	Belgium-Luxembourg 16,989; United Kingdom 13,723; Australia 10,600.
Semimanufactures	4,539	4,921	Belgium-Luxembourg 3,160; West Germany 1,243.

See footnotes at end of table.

Table 3.—Netherlands: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Magnesium metal including alloys:			
Scrap	1,210	1,188	West Germany 665; United Kingdom 168.
Unwrought	3,729	5,287	United States 4,539.
Semimanufactures	66	149	West Germany 94; United Kingdom 13.
Manganese:			
Ore and concentrate	81,242	73,223	Belgium-Luxembourg 806; West Germany 618.
Oxide	1,020	1,153	Belgium-Luxembourg 1,008.
Mercury 76-pound flasks	[r][illegible]18	2,466	Spain 1,102; Algeria 406.
Molybdenum:			
Oxide	236	60	United Kingdom 40; United States 18.
Metal including alloys, all forms	208	153	Belgium-Luxembourg 53; West Germany 37.
Nickel:			
Matte, speiss, similar materials	697	3,224	Cuba 3,058.
Metal including alloys:			
Scrap	2,245	728	United States 209; West Germany 203.
Unwrought	2,442	4,054	Republic of South Africa 2,354.
Semimanufactures	3,850	1,097	West Germany 466; United Kingdom 331; United States 82.
Platinum-group metals, all forms thousand troy ounces	88	61	France 19; Belgium-Luxembourg 10; United Kingdom 9.
Silver metal including alloys, all forms do	9,051	9,000	West Germany 2,656; France 1,996; United Kingdom 1,991.
Tellurium, elemental, and arsenic	34	33	United States 16; Sweden 12.
Tin:			
Ore and concentrate	3,938	2,820	Peru 880; Bolivia 815.
Oxide	100	--	
Metal including alloys:			
Scrap	925	971	France 429; West Germany 331.
Unwrought	5,299	5,430	Thailand 1,255; Malaysia 830; West Germany 668.
Semimanufactures	99	147	West Germany 61; Brazil 25; United Kingdom 23.
Titanium:			
Ore and concentrate (ilmenite)	7,992	1,346	Australia 850.
Oxide	7,946	8,627	West Germany 3,742; Italy 1,683; Spain 1,119.
Metal including alloys, all forms	221	240	United States 154.
Tungsten:			
Ore and concentrate	1,341	1,699	Peru 780; Republic of South Africa 359; Burma 292.
Metal including alloys, all forms	220	205	Belgium-Luxembourg 66; Republic of South Africa 53; United Kingdom 49.
Zinc:			
Ore and concentrate	262,532	307,817	Australia 127,604; Canada 75,476; Ireland 41,206.
Oxide	3,970	4,540	United Kingdom 2,026; France 915; West Germany 900.
Ash and residue	[r]10,104	10,764	West Germany 9,811; France 381; Cuba 150.
Metal including alloys:			
Scrap	6,118	7,191	West Germany 4,828; Belgium-Luxembourg 703; United Kingdom 603.
Dust (blue powder)	4,043	2,918	West Germany 1,545; Belgium-Luxembourg 1,093.
Unwrought	28,240	22,226	West Germany 10,299; Belgium-Luxembourg 6,196.
Semimanufactures	4,466	7,692	West Germany 4,253; Belgium-Luxembourg 2,819; France 430.
Zirconium ore and concentrate	22,885	230	Australia 156.
Other:			
Ores and concentrates of nonferrous metals	27,992	27,708	United States 26,603.
Ash and residue containing nonferrous metals	56,555	771,354	West Germany 584,979; Belgium-Luxembourg 111,767; Canada 58,817.
Metals including alloys, all forms:			
Metalloids:			
Phosphorus	140	105	West Germany 79; East Germany 10.
Selenium	22	12	United Kingdom 7.
Silicon	6,395	4,066	Republic of South Africa 2,815; France 638; Norway 401.
Alkali, alkaline earth, rare-earth metals	NA	76	West Germany 64; France 10.

See footnotes at end of table.

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Table 3.—Netherlands: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Other —Continued			
Metals including alloys, all forms —Continued			
Base metals including alloys, all forms, n.e.s	3,424	3,003	Republic of South Africa 2,141; West Germany 138.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	395	1,626	West Germany 1,618.
Dust and powder of precious and semiprecious stones thousand carats	2,681	1,096	Ireland 615; Switzerland 172; Belgium-Luxembourg 116.
Grinding and polishing stones	2,689	2,628	West Germany 1,333; Austria 406; United Kingdom 203.
Asbestos	39,909	41,357	Canada 28,027; Italy 6,988; West Germany 2,727.
Barite and witherite	130,261	124,608	China, mainland, 24,331; France 22,572; Morocco 21,013.
Boron materials:			
Crude natural borates	350,935	397,570	United States 381,051; Turkey 11,192; Belgium-Luxembourg 4,282.
Oxide and acid	2,733	2,757	France 1,081; Belgium-Luxembourg 328; United States 584.
Cement thousand tons	3,084	3,213	West Germany 1,595; Belgium-Luxembourg 1,592.
Chalk	83,593	78,602	France 59,957; Belgium-Luxembourg 13,480.
Clays and clay products:			
Crude:			
Bentonite	35,186	54,913	United States 23,190; Greece 21,800.
Kaolin	371,919	393,188	United Kingdom 165,580; West Germany 134,843.
Refractory	33,826	31,752	West Germany 19,611; France 4,226.
Other	3,156	3,784	West Germany 2,204; United States 866.
Products:			
Refractory (including nonclay brick)	58,834	53,280	West Germany 32,619; United Kingdom 8,026; Austria 5,072.
Nonrefractory	439,509	561,658	West Germany 249,970; Belgium-Luxembourg 147,271; Italy 80,739.
Cryolite and chiolite	1,666	247	All from Denmark.
Diamond:			
Worked:			
Gem carats	812,020	1,264,874	India 400,056; Israel 364,268; Switzerland 167,463.
Industrial do	560	2,176	United States 1,889.
Unworked:			
Gem thousand carats	493	623	United Kingdom 233; Sierra Leone 110; Liberia 42.
Industrial do	4,141	1,243	United Kingdom 387; Ireland 386; West Germany 204.
Unsorted do	9,181	1,951	United Kingdom 236; Switzerland 207; Ghana 204.
Diatomite and other infusorial earth	15,769	16,241	Denmark 11,241; West Germany 1,611; United States 1,183.
Feldspar, fluorspar leucite	r52,292	65,672	Norway 35,156; Belgium-Luxembourg 8,329.
Fertilizer materials:			
Crude:			
Nitrogenous	25,095	21,076	Chile 20,907.
Phosphatic thousand tons	1,992	2,206	United States 645; Togo 593.
Potassic salts	5,245	3,993	All from West Germany.
Other	72,583	78,245	West Germany 62,463; Belgium-Luxembourg 6,756; Peru 2,001.
Manufactured:			
Nitrogenous	291,198	330,747	Belgium-Luxembourg 198,538; West Germany 45,574; United Kingdom 20,164.
Phosphatic (P_2O_5 content):			
Thomas slag	13,100	8,980	All from Belgium-Luxembourg.
Other	2,006	2,657	East Germany 2,244.
Potassic	216,999	193,725	West Germany 55,018; East Germany 32,397.
Other, including mixed	118,675	113,382	West Germany 35,841; Belgium-Luxembourg 34,319; United Kingdom 18,155.
Ammonia	1,555	101,017	U.S.S.R. 85,031; United States 5,[illegible].
Graphite, natural	456	892	China, mainland, 620; West Germany 161.
Gypsum and plasters	r406,495	390,339	West Germany 219,835; France 121,515.
Lime thousand tons	984	1,020	Belgium-Luxembourg 518; West Germany 500.
Magnesite	58,771	63,032	Greece 37,969; Austria 7,481.
Meerschaum, amber and jet	1,217	--	

See footnotes at end of table.

Table 3.—Netherlands: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Mica:			
Crude, including splittings and waste	1,813	1,918	Norway 626; Canada 419; United States 323.
Worked, including agglomerated splittings	27	34	Belgium-Luxembourg 11; West Germany 8; Switzerland 7.
Stone, sand and gravel:			
Dimension stone:			
Unworked and partly worked thousand tons	1,126	1,049	Belgium-Luxembourg 651; West Germany 322.
Worked	52,423	66,191	Italy 31,136; West Germany 14,744.
Dolomite thousand tons	789	929	Belgium-Luxembourg 820; West Germany 92.
Gravel and crushed rock do.	17,050	14,379	West Germany 9,646; Belgium-Luxembourg 2,275.
Limestone do.	764	819	Belgium-Luxembourg 758.
Quartz and quartzite	28,765	24,954	Norway 12,845; Belgium-Luxembourg 8,778.
Sand, excluding metal bearing thousand tons	7,839	8,088	West Germany 7,293; Belgium-Luxembourg 732.
Sulfur:			
Elemental	233	133	West Germany 103.
Sulfur dioxide	2	--	
Sulfuric acid	250,592	234,780	West Germany 150,803; Finland 31,973; Sweden 17,478.
Talc and steatite	17,473	21,192	Austria 7,863; Norway 7,145; United States 1,547.
Other:			
Crude:			
Quartz, electronic grade kilograms	371	3	All from Switzerland.
Other thousand tons	1,979	1,944	West Germany 1,318; Belgium-Luxembourg 600.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture do.	2,291	2,800	West Germany 2,439; France 211.
Slag and ash, n.e.s do.	554	685	West Germany 580; Belgium-Luxembourg 100.
Oxides of barium, strontium, magnesium	1,463	564	U.S.S.R. 302; West Germany 215.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	4,390	1,726	United States 1,158; West Germany 494.
Carbon black and gas carbon	8,577	8,880	West Germany 6,632; United Kingdom 626.
Coal and briquets:			
Anthracite and bituminious coal thousand tons	5,894	5,031	Australia 1,490; West Germany 1,479; United States 658.
Briquets of anthracite and bituminous coal do.	4	7	All from West Germany.
Lignite and lignite briquets do.	29	70	Do.
Coke and semicoke do.	253	485	West Germany 289; United Kingdom 95; Greece 40.
Gas, natural thousand cubic feet	19,419	110,591	West Germany 103,896.
Peat, including peat briquets and litter thousand tons	386	427	West Germany 414.
Petroleum:[4]			
Crude thousand 42-gallon barrels	449,652	394,149	Saudi Arabia 99,345; Iran 97,191; Nigeria 66,830.
Refinery products:			
Gasoline do.	48,756	52,438	U.S.S.R. 8,291; Belgium-Luxembourg 6,022; Romania 5,074.
Kerosine and jet fuel do.	3,663	3,276	U.S.S.R. 592; Belgium-Luxembourg 804; United Kingdom 313.
Distillate fuel oil do.	14,070	21,175	U.S.S.R. 10,107; United Kingdom 4,265; Bahamas 2,278.
Residual fuel oil do.	7,686	15,236	Belgium-Luxembourg 3,838; United Kingdom 3,310; France 970.
Lubricants do.	1,771	1,884	Belgium-Luxembourg 587; France 259; United States 218.
Other:			
Liquefied petroleum gas[5] do.	3,455	4,715	Belgium-Luxembourg 1,213; West Germany 965; United Kingdom 953.
Mineral jelly and wax do.	298	277	West Germany 102; United Kingdom 41.

See footnotes at end of table.

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Table 3.—Netherlands: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum[4] —Continued			
Refinery products —Continued			
Other —Continued			
Petroleum coke and pitch thousand 42-gallon barrels	2,751	2,799	United States 1,231; West Germany [illegible]
Bituminous mixtures do	325	250	West Germany 134; Belgium-Luxembourg 83.
Unspecified do	2,529	2,950	United States 989; Belgium-Luxembourg 790; West Germany 240.
Total do	r85,284	105,002	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	157,431	598,689	West Germany 138,191; France [illegible]; Belgium-Luxembourg 101,284.

rRevised. NA Not available.
[1] Less than 1/2 unit.
[2] Excluding monetary gold.
[3] Includes spiegeleisen, sponge iron, grit, and pellets.
[4] Includes bunkers.
[5] May include liquefied gases other than propane and butane.

COMMODITY REVIEW

METALS

Aluminum.—ESTEL N.V., the Dutch-West German steel combine that controls Holland Aluminium B.V., operator of the smelter at Delfzijl in northeast Netherlands, announced its intention in 1979 to join with Kaiser Aluminum and Chemical Corp. of the United States to merge the two firms' aluminum smelter and fabricating facilities in Europe. ESTEL had become the sole owner of the smelter when Hollandse Metallurgische Industrie Billiton withdrew in 1977. ESTEL also controlled 61.5% of Sidal N.V., an aluminum fabricator based in Belgium, and its share was scheduled to increase to 100%. Early in 1980, further talks on the merger were postponed until the end of 1980.

Iron and Steel.—For the first time in 3 years, the major Dutch steelmaker, Hoogovens IJmuiden B.V., moved out of the red in 1978 and 1979, as sales—especially to the United States and other foreign markets—increased. Consequently, national steel production rose from 4.9 million tons in 1977 to 5.6 million tons in 1978 and to about 5.8 million tons in 1979. ESTEL N.V., of which Hoogovens was a part, continued to show an overall deficit, but this deficit was declining late in 1979.

Hoogovens nevertheless continued to lose competitiveness in the developing world steel market. Factors that forecast a decline in ESTEL's sales in the next few years—and were grounds for concern according to ESTEL's chairman—were the strong Dutch guilder, which was sustained by the Netherlands' large exports of natural gas; the high labor and materials costs in the Netherlands, which was in part a result of the social legislation of recent years; and the development of cheaper (or subsidized) steelmaking facilities in secondary export markets.

In addition to Hoogovens, with its single steel plant at IJmuiden on the coast west of Amsterdam, one other firm, NFK-Staal B.V., a subsidiary of Thyssen of the Federal Republic of Germany, produced less than 10% of the national total steel output in an electric steel plant at Alblasserdam, near Rotterdam.

Lead.—The 45,000-ton-per-year secondary lead smelter of Hollandse Metallurgische Industrie Billiton (HMIB) at Arnhem was required by new environmental regulations to decrease lead emissions to a maximum of 35 kilograms per 24 hours, which was half the previous limit. Billiton expected the modification to take at least a year to complete and also expected it would be expensive, although no exact cost was released. In 1978, HMIB announced that it would be forced to close its vanadium plant because it was unprofitable (see Vanadium).

Vanadium.—The vanadium plant of Hollandse Metallurgische Industrie Billiton was closed about January 1979. The plant, at the Billiton secondary lead smelter in Arnhem, had treated vanadiferous slag from the Republic of South Africa, but had lost an annual average of 1.5 million guilders over the previous 4 years.

NONMETALS

Limestone.—Ground limestone for industrial, construction, and agricultural purposes is produced by two firms headquartered in Maastricht: Ankersmit's Chemische Fabrieken B.V., which operated plants at Maastricht and Winterswijk with a total grinding capacity of up to 2 million tons per year; and CV Nekami Kalk, which operated plants at Margraten in the Netherlands and Seilles in Belgium, each with a grinding capacity of 400,000 to 500,000 tons per year.

Sulfur.—Construction of a $16.5 million sulfuric acid plant was planned by Climax Molybdenum Co. The plant would recover sulfur in emissions from Climax's molybdenum conversion plant in Rotterdam, and completion was expected by 1981.

MINERAL FUELS

Coal.—Early in 1980, a Government memorandum on the use of coal in the Netherlands was presented to Parliament. The memorandum recommended increasing the share of coal in Dutch energy supplies from the present 1.6% to 20% (or 40% of all electricity generated) by the year 2000. Coal imports would thus increase from 1.5 million tons currently to 26 million tons, since the Dutch mines are uneconomic and all have been closed since 1974. Plans were to decrease the share of electricity generated by natural gas and oil from the present 80% to 20%, and, if politically feasible, to develop nuclear energy for the remaining 40%. Plans also called for placing emphasis on combined cycle use of gasified coal and on fluidized-bed combustion; both are as environmentally acceptable as conventional coal combustion with stack scrubbers.

Three coal gasification projects were being studied in the Netherlands: a semicommercial plant announced by Royal Dutch Shell for Moerdijk, south of Rotterdam, which is expected to use the Shell-Koppers process to supply a 140-megawatt powerplant; an experimental gasification plant to be completed by the Rotterdam Municipal Power Company (GEB) in 1980; and a plant to produce low-calorie gas—for blending into the Dutch distribution system for natural gas—to be built by Nederlandse Gasunie N.V., the monopoly gas distributor, in the Eemshaven area in the northeast part of the country.

Natural Gas.—According to the Gas Marketing Plan submitted to the Ministry of Economics by the Nederlandse Gasunie N.V. (the sole distributor), proven natural gas reserves were 1,677 billion cubic meters on January 1, 1979, and total reserves were 2,271 billion cubic meters, of which about 1,900 billion cubic meters was onshore. Although reserves had declined slightly in 1978, total reserves for 1979 were 223 billion cubic meters more than the yearend 1974 reserves total. Reserves at the largest field, Slochteren, were estimated by the State Geological Service in mid-1979 to be 150 billion cubic meters more than the former estimate, or about 1,700 billion cubic meters. Deliveries of gas by Gasunie also declined by 5% in 1978, to 90 billion cubic meters, as foreign consumers rescheduled their deliveries. Part of the decline in Gasunie's deliveries may also have been a result of the recently changed official policy, which now is aimed at reducing gas use in heavy industrial processes and electric-generation plants. In a status report to the Dutch Parliament, the State Geological Service noted that the recent decline in reserves will be difficult to reverse or even stabilize and recommended extending exploration to parts of the continental shelf that are now off limits, as well as to geological layers below 9,000 feet.

The Netherlands had contracts for a total of 141 billion cubic meters of gas to be obtained from foreign sources, which in effect would extend domestic reserves. These contracts included 61 billion cubic meters from Norway, to be delivered over the next decade through the undersea pipeline to Emden; and 80 billion cubic meters of liquefied natural gas (LNG) from Algeria, to be delivered during a 20-year period starting in 1984. The Algerian LNG was originally expected to be landed at Maasvlakte, near Rotterdam, but in August 1978 the Dutch Cabinet revised its earlier plan and approved the selection of Eemshaven, near Delfzijl in the north, as the site. Although the Government discussed its decision to establish an LNG terminal with the Federal Republic of Germany and Belgium, the European community as a whole did not take part in these discussions, since no European energy policy had yet been established. The facility is expected to be capable of processing 4 billion cubic meters of LNG annually. The Eemshaven site

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would cost an estimated 190 million guilders more than the alternative at Maasvlakte, but the Government considered it more advantageous because it would aid a depressed area that would otherwise require financial support. Also, the Government had experienced difficulty in attracting other industry to Eemshaven.

Production of natural gas offshore continued to increase but was only a small part of the Dutch total, which included production from the huge Groningen Field. The Noordwinning consortium, a group of American and European companies led by Pennzoil Nederland Co., started production in 1978 from the F structure (Rotliegende) in concession bloc K13, at a rate of 1 billion cubic meters per year. In the same bloc, the A structure (first tapped in 1976) and the B structure (1977) yielded about 900 million and 600 million cubic meters, respectively. The total production rate from the Dutch continental shelf is therefore about 2.5 billion cubic meters per year. A 120-kilometer pipeline from the offshore field reaches the coast near Callantsoog, south of Den Helder, and ends in Balgzandpolder, where the gas is treated and delivered to Gasunie. A fourth natural gasfield was being developed on the E structure in bloc K13, with a potential of another 1 billion cubic meters annually by 1980.

Petroleum.—All refineries continued operating well below capacity (which totaled about 93 million tons per year). In most cases, the refineries operated at between 60% and 65% of capacity. The Netherlands' refineries were principally constructed to serve the export market from the complex around Rotterdam, and this market continued to be very competitive.

BP Nederland N.V. completely closed its 320,000 barrel-per-day refinery at Rozenburg near Rotterdam during April and May 1978, except for essential maintenance. Shell Nederland B.V. replaced one of its large distillation units with a smaller one nearby, at its Pernis (Rotterdam) refinery (530,000 barrels per day). Esso Nederland B.V. at Europoort, Rotterdam (176,000 barrels per day), Mobil Oil B.V. at Amsterdam (125,000 barrels per day), and Gulf Oil B.V. at Rozenburg (76,000 barrels per day) were also in a precarious position. Late in the year, the Total Nederland N.V. refinery at Flushing (150,000 barrels per day) announced plans to discontinue operations. The other two Dutch refineries were Chevron Petroleum B.V. at Pernis (300,000 barrels per day) and the small Smid & Hollander B.V. refinery at Amsterdam (7,000 barrels per day). The total domestic capacity for crude distillation (before Shell's alteration) was thus, by one reckoning, about 1.6 million barrels per day.

The Nederlandse Aardolie Maatschappij B.V. (NAM), owned 50% by the Government and 25% each by Shell and Exxon, was the only crude oil producer in the Netherlands. NAM continued efforts to boost production, particularly in the Schoonebeek Field near the Federal Republic of Germany border, which produced 60% of the domestic total. A 175-million-guilder 6-year NAM program was aimed at almost doubling daily production to about 5,000 tons by 1981.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Hfl2.0 (2.0 Netherlands guilders)=US$1.00, exchange rate in 1978 and 1979.

The Mineral Industry of New Zealand

By Charlie Wyche[1]

New Zealand's most significant mineral activity in 1978 and 1979 was the production of construction materials, including limestone, sand and gravel, aggregates, and clay; and the value of this production was higher than that of any of the country's other mineral products. Coal, iron sands, natural gas, and a small quantity of gold and silver accounted for virtually all the remaining mineral value. Several prospects, including gold, molybdenum, and asbestos, were being investigated and could contribute to New Zealand's mineral value in the early 1980's.

Natural gas operations and associated condensate production could play an increasingly important role in New Zealand's future energy program. The offshore Maui gasfield began production in late 1979, and development continued at the onshore Kapuni gasfield. A comprehensive policy concerning private oil and gas exploration was announced in 1979, and the mining industry subsequently increased its exploration activity significantly. New Government-sponsored exploration was also being initiated.

Imports of crude oil and refinery products supplied about one-third of the national energy requirements. Planned development of coal, natural gas, hydroelectric power, and geothermal power was expected to reduce petroleum imports to 20% to 25% of the total energy requirement by 1990. In 1978, geothermal steam at the Wairakei power station generated 5.5% of New Zealand's total electricity.

The number of conflicts between mining and conservationist interests over environmental issues declined in 1978 and 1979. The conservationists believed current environmental requirements were inadequate and wanted a total restriction on exploration and mining in certain areas. Government agencies proposed no new or enlarged reserved areas, such as national parks or wilderness areas, in 1978 or 1979.

PRODUCTION

The value of New Zealand's mine and quarry output for 1978, including metals and nonmetals but not mineral fuels, was $150 million,[2] or 0.9% of the country's $16.7 billion gross national product (GNP). The estimated mineral production value for 1979 was slightly higher, at $153 million. There were no significant production shifts noted between 1978 and 1979. Values of the most significant minerals produced during 1978 were as follows (in thousand dollars): Sand and gravel ($51,873); coal ($45,658); iron sand concentrate ($22,000); limestone for agriculture, roads, cement, and other industries ($12,400); gold ($1,700); clays for brick, tile, and pottery ($1,600); salt ($689); serpentine ($600); and silica ($583).

The establishment of a $60 million nickel smelter at Bluff in Southland was being considered. It was proposed that nickel ore from New Caledonia would be used as feedstock for the smelter. The plans have been discussed with Government officials, and feasibility studies were being conducted.

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Table 1.—New Zealand: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum metal, smelter	139,800	124,549	151,100	[illegible]
Copper ore and concentrate	--	154	38	[illegible]
Gold, mine output, metal content troy ounces	3,276	7,168	7,044	[illegible]
Iron and steel:				
Iron ore, gross weight	185	200	170	[illegible]
Iron sand, gross weight[2]	[r]2,473,672	2,772,000	3,768,370	[illegible]
Sponge iron thousand tons	[e]50	12	28	[illegible]
Crude steel do	[e]200	124	180	[illegible]
Silver, mine output, metal content troy ounces	[r]1,000	7,572	2,013	[illegible]
Tungsten, mine output, metal content	8	6	9	[illegible]
Zinc ore and concentrate	--	132	[e]140	[illegible]
NONMETALS				
Cement, hydraulic thousand tons	999	910	798	[illegible]
Clays:				
Bentonite	1,042	998	998	[illegible]
Fire clay	260,811	173,008	118,734	[illegible]
Kaolin (including china clay)	58,834	94,742	33,741	[illegible]
Diatomite	[e]3,000	1,113	998	[illegible]
Magnesite	805	557	840	[illegible]
Perlite	1,500	1,000	558	[illegible]
Pumice	50,232	28,550	39,468	[illegible]
Salt	43,000	53,000	65,000	[illegible]
Sand and gravel:				
Glass sand	142,955	146,486	127,998	[illegible]
Common sand and gravel[3] thousand tons	20,881	21,477	20,306	[illegible]
Stone:				
Dolomite	23,129	23,070	[e]24,000	[illegible]
Greenstone	6	30	[e]40	[illegible]
Limestone and marl:				
For agriculture thousand tons	1,686	1,732	1,615	[illegible]
For roads do	274	308	250	[illegible]
For industry, except cement do	165	170	159	[illegible]
For cement do	1,674	1,590	1,306	[illegible]
Serpentine do	72	89	[e]90	[illegible]
Unspecified:				
Dimension	26,328	16,828	[e]20,000	[illegible]
Rock for harbor work thousand tons	3,200	3,300	[e]3,400	[illegible]
Sulfur	[r]1,000	1,000	1,000	[illegible]
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Bituminous thousand tons	445	389	360	[illegible]
Subbituminous do	1,872	1,817	1,683	
Lignite do	170	162	150	[illegible]
Total do	2,487	2,368	2,193	[illegible]
Coke, gashouse do	41	93	[e]100	[illegible]
Fuel briquets do	11	13	[e]15	15
Gas, natural:[4]				
Gross million cubic feet	32,000	51,000	49,000	[illegible]
Marketed do	30,945	49,426	47,466	[illegible]
Natural gas liquids thousand 42-gallon barrels	86	100	[e]100	[illegible]
Petroleum:				
Crude[5] do	3,776	5,391	4,555	[illegible]
Refinery products:				
Gasoline do	12,052	10,846	10,057	[illegible]
Distillate fuel oil do	5,168	4,894	4,692	[illegible]
Residual fuel oil do	7,795	7,093	5,668	[illegible]
Other do	674	780	600	[illegible]
Refinery fuel and losses do	1,704	909	695	[illegible]
Total do	27,393	24,552	21,712	[illegible]

[e]Estimate. [p]Preliminary. [r]Revised.

[1] Reported figure.

[2] Average 57% Fe.

[3] Includes crushed rock for building aggregate, roads, and ballast.

[4] Excludes carbon dioxide component of natural gas, which is reported separately.

[5] Includes field condensate.

TRADE

According to the Department of Statistics at Wellington, principal mineral exports during FY 1978 (the fiscal year ending June 30, 1978) were aluminum and aluminum alloys (valued at $107.9 million) and iron ore and concentrates ($24.1 million). For FY 1979, the export value of aluminum and aluminum alloys rose (to $153.0 million), as did the value of iron ore and concentrates ($25 million).

Crude petroleum, partly refined petroleum, and petroleum refinery products dominated New Zealand's mineral imports. Imports in these three categories were valued at $437.5 million in FY 1978 and at $472.4 million in FY 1979. Iran remained the principal import source, but Kuwait and Saudi Arabia were also significant suppliers. Imports of iron and steel, mainly semimanufactures, totaled $152.4 million in FY 1978 and $194.3 million in FY 1979. Large quantities of phosphate rock from Nauru, sulfur from the United States, and alumina from Australia were also imported during 1978 and 1979.

The Government planned to export up to 250,000 tons of coal annually from the Buller coalfield in the northwest area of Southland, beginning in the early 1980's. This trade, estimated at $10 million annually, would constitute the country's first major coal export of recent times. Probable customers were Japan, South Korea, Taiwan, Hong Kong, and Singapore. Another proposal, for the sale of $30 million of coking coal to Japan, was deferred.

Table 2.—New Zealand: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite and concentrate	232	53	Netherlands 35; Belgium-Luxembourg 17.
Metal including alloys:			
Scrap	1,953	1,540	Japan 1,483.
Unwrought	2,599	114,659	Japan 106,250; Hong Kong 5,358.
Semimanufactures	858	1,522	Australia 463; Singapore 258; United Arab Emirates 167.
Copper:			
Ore and concentrate	98	613	China, mainland, 500.
Metal including alloys:			
Scrap	493	800	Australia 672; United Kingdom 128.
Unwrought and semimanufactures	1,316	1,951	Singapore 634; Malaysia 355; Thailand 276.
Iron and steel:			
Ore and concentrate thousand tons	2,223	3,079	Japan 3,036.
Metal:			
Scrap	2,161	1,391	Japan 1,026.
Pig iron, spiegeleisen, sponge iron, ferroalloys	174	4	All to Indonesia.
Ingots, blooms, billets, sheet bars	866	15,688	Venezuela 15,091; Philippines 480.
Semimanufactures:			
Bars, rods, angles, shapes, sections	16,140	34,797	United States 15,435; Canada 13,897.
Universals, plates, sheets	27,537	41,574	United States 28,723; Papua New Guinea 3,116.
Hoop and strip	11	21	Fiji 15.
Wire	5,572	6,631	United States 4,696; Canada 644.
Tubes, pipes, fittings	1,091	1,018	Fiji 307; Papua New Guinea 162.
Castings and forgings, rough	75	139	Australia 129.
Total	50,426	84,180	
Lead:			
Oxides	386	55	Taiwan 54.
Metal including alloys:			
Scrap	347	481	West Germany 188; Japan 188.
Unwrought and semimanufactures	204	240	Australia 146; Fiji 53.
Magnesium metal including alloys, all forms	10	3	West Germany 2.
Platinum-group metals and silver:			
Ores and concentrates	4	7	United Kingdom 6.
Metals:			
Platinum-group troy ounces	1	56	NA.
Silver do.	276	1,423	Fiji 619; Australia 257.
Zinc metal including alloys:			
Scrap and blue powder	1,580	910	Japan 462.
Unwrought and semimanufactures	279	146	Taiwan 100; Australia 23.

See footnotes at end of table.

Table 2.—New Zealand: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Other:			
Ores and concentrates	200	51	Australia 25; West Germany 18.
Ash and residue containing nonferrous metals value, thousands	$192	$179	United Kingdom $61; Japan $53.
Oxides, hydroxides, peroxides of metals do	$6	$46	Australia $19; American Samoa $16.
NONMETALS			
Abrasives, natural, n.e.s.: Pumice, emery, natural corundum, etc	316	324	Australia 206; Fiji 70.
Cement	763	1,085	Norfolk Island 545; Western Samoa 419.
Clays and clay products (including all refractory brick):			
Crude	817	655	Japan 403; Australia 171.
Products:			
Refractory (including nonclay brick) value, thousands	$49	$97	French Polynesia $41; Australia $26; Fiji $13.
Nonrefractory do	$311	$517	Australia $348; Singapore $68.
Fertilizer materials:			
Crude:			
Phosphatic	2	14	Tonga 6; Western Samoa 5.
Potassic	--	3	All to Tonga.
Other	2	51	Malaysia 23; Fiji 20.
Manufactured:			
Nitrogenous	134	532	Western Samoa 502.
Phosphatic	442	3,379	Fiji 2,745.
Potassic	82	654	Fiji 651.
Other, including mixed	279	312	Australia 199; Japan 37; Papua New Guinea 23.
Lime	338	44	Fiji 29.
Precious and semiprecious stones value, thousands	$2	$12	Australia $11.
Salt	536	1,606	Australia 1,349.
Stone, sand and gravel:			
Limestone	554	40	Fiji 23; Thailand 8.
Gravel and crushed rock	28	66	Australia 56; Fiji 10.
Sand, excluding metal bearing	16	64	Hong Kong 54; Fiji 6.
Other:			
Crude	1,661	2,344	Australia 2,304.
Slag, dross, and similar waste, not metal bearing	3	19	All to Denmark.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s value, thousands	$1,696	$1,956	Nigeria $567; Fiji $533.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	637	508	New Caledonia 301; Western Samoa 20
Coal, including briquets	10,619	10,981	Japan 10,824.
Coke and semicoke	16,886	5,002	All to Republic of Korea.
Petroleum refinery products:			
Distillate fuel oil thousand 42-gallon barrels	993	978	Ship stores 956.
Residual fuel oil do	1,434	1,273	Ship stores 1,023.
Lubricants do	264	157	Fiji 91.
Mineral jelly and wax do	14	181	Australia 77; Thailand 57; Fiji 40.
Bituminous mixtures, n.e.s do	1,883	3,660	New Caledonia 3,109.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	115	184	Fiji 181.

NA Not available.

[1] Data are for the New Zealand fiscal year, which is the year ending June 30 of that stated.

Table 3.—New Zealand: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977[1]	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate	592	635	Guyana 496.
Oxide and hydroxide	255,829	331,403	Australia 326,034; Japan 4,687.
Metal including alloys:			
Unwrought	274	180	Australia 124; United Kingdom 36.
Semimanufactures	3,053	2,539	Australia 943; Japan 549; United States 493.
Arsenic trioxide, pentoxide, acids	2,009	1,872	United Kingdom 1,598.
Chromium oxide and hydroxide	196	159	West Germany 57; United Kingdom 38.
Cobalt oxide and hydroxide	8	7	United Kingdom 6.
Copper metal including alloys:			
Unwrought	2,250	1,241	Australia 1,028.
Semimanufactures[2]	12,546	11,061	Australia 9,842.
Iron and steel metal:			
Scrap	17,036	16,962	United States 15,783.
Pig iron, ferroalloys, similar materials	6,570	5,246	Australia 3,522; Republic of South Africa 635.
Steel, primary forms	4,190	4,863	Australia 4,781.
Semimanufactures:			
Bars, rods, angles, shapes, sections	109,537	70,063	Australia 32,245; Japan 30,479.
Universals, plates, sheets	378,298	318,040	Japan 243,825; Australia 52,037.
Hoop and strip	28,853	27,563	Australia 19,765; Japan 5,643.
Rails and accessories	9,845	4,316	Japan 3,297; Australia 766.
Wire	32,675	13,755	Australia 5,781; Japan 4,813.
Tubes, pipes, fittings	23,330	22,828	Japan 12,847; Australia 5,435; United Kingdom 1,769.
Castings and forgings, rough	342	719	Australia 479; United Kingdom 223.
Lead:			
Oxides	307	165	Australia 155.
Metal including alloys, unwrought	7,513	8,629	Australia 8,539.
Magnesium metal including alloys, unwrought	527	124	United States 118.
Manganese:			
Ore and concentrate	36	14	Australia 13.
Oxides	1,313	1,140	Australia 458; Ghana 326; Japan 187; United States 150.
Nickel metal including alloys:			
Unwrought	6	100	All from Canada.
Semimanufactures	373	236	United States 85; Canada 57; United Kingdom 45.
Platinum-group metals and silver:			
Waste and sweepings value, thousands	$2,453	$344	Australia $343.
Metals including alloys:			
Platinum-group thousand troy ounces	3	2	Australia 1.
Silver do.	1,782	1,524	Australia 1,450; United Kingdom 54.
Tin:			
Oxides	8	8	West Germany 4; Australia 3.
Metal including alloys:			
Unwrought	341	249	Australia 230.
Semimanufactures	117	8	United Kingdom 6.
Titanium oxides	2,769	2,041	Australia 1,032; United Kingdom 500; Finland 248.
Tungsten metal including alloys, all forms value, thousands	$404	$391	United Kingdom $326.
Zinc:			
Oxide	26	55	Australia 25; Canada 20.
Metal including alloys:			
Unwrought	23,345	17,311	Australia 16,715.
Semimanufactures	311	293	Canada 126; Australia 70.
Other:			
Ores and concentrates of molybdenum, tantalum, titanium, vanadium, zirconium	181	259	Australia 232.
Oxides, hydroxides, peroxides of metals	389	441	United States 237; Norway 101.
Metals including alloys, all forms:			
Metalloids value, thousands	$286	$340	Republic of South Africa $221.
Base metals including alloys, all forms, n.e.s do.	$449	$400	China, mainland, $189; United Kingdom $77; Belgium-Luxembourg $44.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	89	92	United States 79.
Grinding and polishing wheels and stones value, thousands	$1,279	$1,501	Australia $475; United Kingdom $401; Japan $195.
Asbestos	5,095	8,525	Canada 7,498; Republic of South Africa 1,024.
Barite and witherite	1,747	1,169	Australia 622; China, mainland, 505.

See footnotes at end of table.

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Table 3.—New Zealand: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977[1]	1978	Principal sources, 1978
NONMETALS —Continued			
Boron materials:			
Crude natural borates value, thousands	$15	$2	All from United Kingdom.
Oxide and acid	443	384	United States 383.
Cement	4,309	3,117	Japan 1,363; United Kingdom 816.
Chalk	845	707	United Kingdom 555; France 138.
Clays and clay products (including all refractory brick):			
Crude	9,953	7,885	United States 5,314; United Kingdom 1,616.
Products:			
Refractory (including nonclay brick) value, thousands	$3,202	$4,229	United Kingdom $1,764; Australia $1,0
Nonrefractory do	$500	$723	Japan $357; Philippines $130.
Diamond:			
Gem, not set or strung do	$1,592	$2,743	Israel $1,008; India $914.
Industrial do	$143	$89	Australia $27; United Kingdom $22.
Diatomite and other infusorial earth	793	555	United States 410; Japan 138.
Feldspar, fluorspar, nepheline syenite	1,925	1,747	Norway 1,034; China, mainland, 570.
Fertilizer materials:			
Crude:			
Nitrogenous	NA	263	Chile 250.
Phosphatic thousand tons	1,050	1,137	Australia 575; Nauru 462.
Manufactured:			
Nitrogenous	68,629	81,093	Japan 38,606; Netherlands 20,037; Australia 6,291.
Phosphatic	2,615	5,448	Canada 4,350.
Potassic	[3]228,088	235,573	United States 136,709; U.S.S.R. 58,0 Canada 36,336.
Other, including mixed[4]	33,523	29,722	United States 26,664; West Germany 1,356.
Ammonia	908	471	Australia 467.
Graphite, natural	67	137	United Kingdom 101.
Gypsum and plasters	111,111	140,610	Australia 98,670; Japan 41,322.
Magnesite	1,088	976	China, mainland, 902.
Mica:			
Crude, including splittings and waste value, thousands	$53	$58	United Kingdom $17; United States $1
Worked, including agglomerated splittings do	$174	$178	United Kingdom $119; Australia $5
Pigments, mineral:			
Natural, crude	198	219	Austria 202.
Iron oxides, processed	929	717	West Germany 537; Spain 145.
Precious and semiprecious stones, except diamond:			
Natural value, thousands	$1,170	$1,104	Thailand $321; West Germany $277; Australia $234.
Manufactured do	$40	$53	West Germany $38; Switzerland $12.
Salt	61,858	58,737	Netherlands Antilles 57,830.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	20,771	20,416	United Kingdom 16,949; United States 2,413.
Caustic potash and sodic and potassic peroxides	344	809	United States 281; U.S.S.R. 161; France 155.
Stone:			
Dimension:			
Crude and partly worked	738	919	Republic of South Africa 462; Finland 1 Italy 111.
Worked value, thousands	$320	$382	Italy $128; Australia $103; Yugoslavia $
Quartz and quartzite	166	126	Sweden 49; Belgium-Luxembourg 44; United Kingdom 28.
Sulfur, elemental, other than colloidal	229,803	234,899	Canada 227,283.
Talc, steatite, soapstone, pyrophyllite	3,963	2,623	Australia 1,991; China, mainland, 5
Other:			
Crude value, thousands	$37	$48	Republic of South Africa $30; West Germany $11.
Oxides and hydroxides of magnesium, strontium, barium	1,542	1,729	Australia 1,469.
Bromine, iodine, fluorine	12	9	All from Japan.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s value, thousands	$101	$125	Australia $57; United Kingdom $ United States $29.

See footnotes at end of table.

Table 3.—New Zealand: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977[1]	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	8,424	8,319	Australia 7,838.
Coal including briquets	653	1,982	United States 1,188.
Coke and semicoke	2,316	2,231	Australia 2,148.
Gas, hydrocarbon ..... value, thousands	$43	$63	Australia $22; France $20; Sweden $15.
Hydrogen and rare gases	1,003	764	Australia 726.
Peat, including peat briquets and litter	62	77	Ireland 50; Norway 24.
Petroleum:			
Crude and partly refined:			
Crude .. thousand 42-gallon barrels	15,915	12,378	Saudi Arabia 6,643; Iran 4,790.
Partly refined ..... do	6,612	4,898	Australia 1,370; Bahrain 999; Saudi Arabia 803.
Refinery products:			
Gasoline ..... do	2,733	4,244	Australia 1,286; Bahrain 911; Italy 343.
Kerosine and jet fuel ..... do	2,337	2,839	Australia 1,947; Singapore 618.
Distillate fuel oil ..... do	2,365	3,321	Australia 1,820; Bahrain 836; Singapore 598.
Residual fuel oil ..... do	294	14	All from Australia.
Lubricants[5] ..... do	411	990	Australia 456; United Kingdom 272; Singapore 148.
Other:			
Nonlubricating oils, n.e.s. do	64	63	Singapore 32; United States 15; Australia 12.
Mineral jelly and wax ..... do	43	30	China, mainland, 14; United Kingdom 7; Japan 3.
Pitch ..... do	116	85	Australia 84.
Bituminous mixtures, n.e.s ..... do	5	2	All from Australia.
Petroleum coke[6] ..... do	364	295	All from United States.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ..... value, thousands	$1,502	$1,829	Japan $1,259; Australia $222; United States $155.

NA Not available.
[1] Data are for the New Zealand fiscal year, which is the year ending June 30 of that stated.
[2] Excludes copper foil, powders, and flakes valued at $2,028,536 in 1977 and $1,507,890 in 1978.
[3] Excludes quantity valued at $212.
[4] Excludes quantities valued at $37,100 in 1977 and $41,797 in 1978.
[5] Excludes quantities valued at $565,626 in 1977 and $241,294 in 1978.
[6] Excludes quantites valued at $1,108 in 1977 and $222 in 1978.

COMMODITY REVIEW

METALS

Aluminum.—The Government of New Zealand and New Zealand Aluminium Smelters Ltd. (NZAS) agreed to terms that increased electric power rates 4.5-fold in April 1978. These rates, which were continued throughout 1979, had an adverse effect on NZAS' expansion plans. The Bluff smelter, which is located near the tip of Bluff Harbor's Tiwai Peninsula, had a capacity of 150,000 tons per year. Plans to expand its capacity to 220,000 tons per year were deferred, following the levy of increased electrical rates on the company.

Gold.—Mine production of gold declined slightly in both 1978 and 1979 from that reported for the past several years. Kanieri Gold Dredging Ltd. produced some 6,000 troy ounces of gold in 1978 from 2.7 million cubic meters of gravels dredged from the Taramakau River near Kumaru, South Island. The year was a difficult one for the company because of machinery breakdowns, labor shortages, escalation in costs, and delays in deliveries of replacement parts. Litigation over purchases of adjoining lands, delays in the issue of a mining license, and disagreements over water rights also caused problems. The grade of the alluvial gold mined by Kanieri was

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among the lowest gold grades in the world. All gold from the Kanieri operation was purchased by the Government. Because of the sharp rise in gold prices in 1979, companies were conducting prospecting and exploration activities on both the South and North Islands.

Mineral Resources (New Zealand) Ltd. continued exploration throughout 1979 at the Martha mine, Waihi, North Island. Mine dumps at Union Hill were being worked, and bulk samples were evaluated. Blackwater Gold Ltd. and Carpentaria Exploration Co. Pty. Ltd. continued testing ore extensions at a former property of Blackwater Mines. Amoco Minerals New Zealand Ltd. received a prospecting license for the Monowai gold area.

Iron Sands.—Output of iron sand concentrate by the two producing companies (New Zealand Steel Mining Ltd., a wholly owned subsidiary of New Zealand Steel Ltd., and Waipipi Ironsand Ltd.) again reached record high levels during 1978 and 1979. New Zealand Steel produced steel and mined iron sands through its subsidiary, New Zealand Steel Mining; Waipipi only mined iron sands. Expansion of iron sand production capacity was completed by New Zealand Steel Mining and Waipipi; and expansion of New Zealand's only steel-producing plant, which was operated by New Zealand Steel, was expected to be completed in 1980.

Waipipi Iron Sands produced some 2.2 million tons of concentrate at Waverly during 1978 and some 3.0 million tons in 1979. Waipipi exported most of its output under a 10-year contract with the Japanese steel industry. It was estimated that the current mine output can be sustained for about 14 years.

New Zealand's iron sand reserves of more than 5 billion tons far exceeded any foreseeable domestic requirements. Also, the world's greatest potential reserves of titanomagnetite deposits are located on the west coast of North Island.

Steel.—New Zealand Steel produced iron sands at its Waikato North Head deposit for use in its direct-reduction steelmaking plant at Glenbrook. The plant at Waikato North Head was designed to produce 200,000 tons of concentrate annually, but in 1978 its annual capacity was expanded to 250,000 tons. Some 150,000 tons of raw steel was produced during 1978, and around 200,000 tons was produced in 1979. This figure was expected to increase to about 750,000 tons annually within 10 years. A cold-rolling mill and coat line for plain and galvanized sheet steel were being considered. Long-range plans included a new melt shop, continuous slab facilities, and more direct-reduction kilns.

Other Metals.—In 1978 and 1979, the Department of Scientific and Industrial Research continued its investigation of black heavy-metal beach-sand deposits on the west coast of South Island. These sands contain ilmenite, monazite, zircon, and gold.

Amoco Minerals was granted prospecting licenses on Ceromandel Peninsula, North Island, and began conducting airborne magnetometric surveys in search of base metals. Otter Minerals Exploration Ltd., in partnership with Gold Mines of New Zealand Ltd., continued exploration in Nelson Province and a drilling operation on D'Urville Island. Gold Mines of New Zealand Ltd., a partnership of Australian Anglo American Corp. Ltd. and Amoil New Zealand Ltd., remained active in the Raukumara, East Cape, and Kaikoura regions.

NONMETALS

Asbestos.—Chrysotile asbestos occurs at several deposits in the serpentines at Nelson and Otago on South Island, but there was no mining in New Zealand in 1978 and 1979. A deposit found in the northwest Otago (along the Pyke River) by Asarco Exploration Co. of Canada Ltd. was found not to be of commercial value.

Phosphate.—Research carried out by the New Zealand Oceanographic Institute in 1978 and 1979 indicated the presence of under sea phosphorite nodules varying in diameter from 10 to 150 millimeters. Most of the deposits were found in water from 400 to 500 meters deep, and none were found at depths less than 200 meters. The phosphorite occured mostly within an irregular east-west belt that was up to about 16 kilometers wide and extended along the crest of Chatham Rise, which runs 1,300 kilometers east of Banks Peninsula, South Island. The P_2O_5 values for the phosphorites generally range between 18% and 24%, and the highest recorded content was 27.7%.

Sulfur.—Fletcher Mining Co. Ltd. continued excavation of a pit in the Taupo area of North Island to provide information from which to develop economic data for an open pit sulfur operation. The intention was to mine the ore by open pit methods and extract the molten sulfur by using hot water under pressure, followed by sulfur recovery using a solvent. The sulfur reserve is contained in mixed pumice and was estimated at 6 million tons.

Other Nonmetals.—In 1978 and 1979, serpentine was produced at Propio and the North Cape, North Island; and Lee Valley, Collins Valley, and Mossburn, South Island.

Sand and gravel production from several new rock quarries near Nelson, South Island, reached full capacity in 1979. Quarry activity for sand and gravel and various stone was high, particularly near cities.

MINERAL FUELS

Coal.—New Zealand produced 2.2 million tons of coal in 1978 and some 2.8 million tons in 1979, from about 70 mines in various fields on North and South Islands. Nearly 75% of the production was from open pit mines. There was an increase in production from private mines in both 1978 and 1979, and development work on three new coal mines was on schedule. Prospecting for new deposits on both North and South Islands continued in 1978 and 1979. Investigations on North Island were mainly in the Coramandel District, between the Huntly and Maramarua fields. On South Island, investigations were being carried out in the Nelson-Westland and Central Otago Districts.

The Government removed the Energy Resources Levy from underground coal mine production on June 1, 1978. The levy had been $2 per ton for other than South Island lignite and $1.50 per ton for South Island lignite.

A new Coal Mining Bill introduced into Parliament was being examined by Parliament's select committee on commerce and mining. The Coal Mining Bill would give the Government much more control over all private coal mining, but would not involve it in taking over the ownership of land or coal mines. Under the new proposals, all coal mining activity would be licensed by the Minister of Energy.

The Department of Mines' 5-year coal exploration program estimated recoverable coal reserves at 1.2 billion tons. Measured reserves of coal totaled 210 million tons. The exploration program started in the eastern part of the Southland lignite field in Mataura Valley, South Island, and was scheduled to continue in the Waikato area, North Island, and in the area of the west coast deposits of South Island.

Natural Gas.—Natural gas and some condensate were produced at the Kapuni offshore field in 1978 and 1979; and gas was supplied to Auckland, Wellington, and to the New Plymouth and Stratford power stations. Also, a proposed ammonia-urea fertilizer plant that would use Kapuni gas was being studied.

Construction of the first production platform by Shell-BP-Todd Oil Services Ltd. for the Maui offshore gasfield was being completed. Drilling of the first production well began in early 1978, and the first gas from Maui began flowing ashore in early 1979. Maui gasfield reserves were estimated at 150 billion cubic meters of gas and 75 million barrels of condensate.

Recently, the New Zealand Government announced a delay in the construction of a second production platform in the offshore Maui gasfield. The postponement was related to the Government's decision to seek to use the gas in the production of methanol. The delay beyond the proposed completion date of 1983 was expected to add greatly to both the capital cost of the project and the unit cost of gas produced.

Petroleum.—The Government announced a comprehensive petroleum exploration policy in 1979. In instances where the Government accepts a company's petroluem exploration proposal, the Government would retain the right to acquire a 51% interest in the discovery in exchange for a 40% contribution to the exploration costs. Smaller contributions to exploration costs by the Government would entitle it to a lower share of the venture. Should either party to such an arrangement decide not to contribute to the costs of a particular well, the remaining party or parties could proceed on a sole-risk basis. In the event of a discovery, the parties contributing to the cost of drilling would be permitted to recover 600% of their expenditure as a prior charge against first production. Royalties to be paid to the Government on oil found were set at 12.5% of the sale value. The price of indigenous oil was raised to that of world crude oil.

New Zealand's only important known oil resources were in the Maui and Kapuni natural gasfields. Production by Shell-BP-Todd Oil Services (in equal partnership with the Government) increased significantly over that of recent years. A light crude oil, or condensate, was produced as a joint product with natural gas.

Shell-BP-Todd signed an agreement with the Government of New Zealand to undertake a $40 million, three-well oil search of the western tip of North Island. Drilling was expected to commence in mid-1980. New Zealand Petroleum, a local exploration

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firm in which Triton Oil of Dallas (United States) has an interest, also revealed plans to resume its oil search off the southwest coast of South Island.

Production of liquefied petroleum gas at Kapuni reached a record high in 1979, but market demand still exceeded supply. An extraction plant was planned to strip liquefied petroleum gas from the Maui gas stream, but was not expected to be operational until 1981. Proposals from distributors to import liquefied petroleum gas from Australia were under consideration by the Government and were expected to be approved in early 1980. The problem of excessive demand resulted from the conversion to liquefied petroleum gas by several vehicle fleet operators and some industrial users following the 1978 introduction of generous tax rebate provisions for new users.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from New Zealand dollars (NZ$) to U.S. dollars at the rate of NZ$1.00 = US$1.06, the exchange rate as of Mar. 31, 1979.

The Mineral Industry of Nigeria

By Janice L. W. Jolly[1]

The fortunes of the petroleum industry formed the cornerstone of Nigeria's economic health, providing over 90% of export earnings and from 22% (1978) to about 30% (1979) of the Nation's gross domestic product (GDP), estimated at $43 billion[2] for 1978 and about $50 billion in 1979 at current prices. Because of lower oil production and marginal agricultural growth, the Nigerian economy made little progress in 1978. Real GDP in the 1978-79 fiscal year (April-March) grew by an estimated 2.5%, in contrast to 10.8% and 9.9% in the two previous years. By yearend 1978 the Iranian oil crisis was to provide the Nigerian petroleum industry with a revived demand and new incentive and an economic recovery in 1979. For the last several years, however, steadily decreasing petroleum production and Government overspending had reduced Nigeria's total foreign reserves from $5.6 billion in 1975 to $1.9 billion at yearend 1978. Faced with continuing high inflation (never lower than 20% per year), balance of payments difficulties, and a high level of deficit financing, the Federal Military Government (FMG) applied brakes to the economy in early 1978. Government spending was slashed back, major curbs were placed on imports, and additional measures were taken to reduce liquidity and curb inflation. The immediate result for 1978 was a sharp downturn in economic activity. Petroleum output hit bottom at 1.52 million barrels per day in March 1978, down 32% from the comparable month of 1977. By 1979, petroleum production had increased to an average of 2.3 million barrels per day and successive price increases had helped to improve Nigeria's oil income considerably. Nigeria had a balance of payments surplus for 1979, compared with a deficit of about $3.6 billion for 1978.

Nigeria's financial troubles caused modification of development planning with some deferment or altering of scope of some projects. Projects already underway, even those awarded to foreign companies, were subject to close monitoring and reassessment by the new Civilian Government elected in October 1979. Projects expected to remain active included natural gas gathering systems, liquefied natural gas plants and shipping systems, petrochemical plants, fertilizer plants, port development, railroads, iron and steel plants and mills, petroleum pipelines and refineries, cement plants, and power facilities. A recent progress report on the Third National Development Plan, 1975-80, showed $6.25 billion was spent by the public and private sectors over the first 2 years of the plan period. In manufacturing, these investments had totaled about $480 million, or about 14% of the planned expenditure. The report also stressed that the continuing problems of manpower shortage had inhibited implementation of many plans. There was an acute shortage of technical personnel, and the new civilian government was planning to increase training programs.

A lack of finance caused Nigeria to go to the Eurodollar market for three very large loans. The first, signed in December 1977, was for $ 81 billion for petroleum, cement, iron and steel, port development, and smaller projects. The second, signed in November 1978, was for $750 million intended for petroleum refining, pipelines, and other projects. Early in 1979, a third loan in excess of $1 billion was also obtained from Federal Republic of Germany banks for a direct-reduction steel plant.

Nigeria remained a difficult environment for foreign investors and businessmen. Compounding the economic slump were the measures introduced to stem imports, reduce foreign exchange outflows, and restructure the ownership of the Nigerian economy. By yearend 1978, all firms that included some foreign ownership were to be in compliance with the indigenization law of 1977, which required from 40% to 100% Nigerian ownership, depending upon the business sector or the ruling of the Nigerian Enterprise Promotion Board. Agents or distributors were also to be at least 60% Nigerian, except for commission agents and distributors, who were to be entirely Nigerian. In December 1978, the FMG announced that a firm established in Nigeria after January 1, 1979, could have a liaison office for 2 years, during which period it would look for a Nigerian partner in order to formally start business operations in compliance with the investment law. Nigeria also introduced a new taxation on foreign airlines and shipping companies in 1978. The tax was set at 10% of the companies' Nigerian turnover on any cash that they remit out of the country. Attributed as a further attempt at discouraging imports, the new tax followed the scrapping of the section in the Nigerian Companies Tax Act of 1961 that exempted shipping and airline companies of countries that offered reciprocal exemption to Nigerian companies. At the same time, double taxation agreements were terminated with nine countries including the United States.[3] Corporate business taxes were increased from 45% to 50%. By yearend 1979, Nigeria had established the National Office of Industrial Prosperity to permit easier identification, evaluation, and selection of foreign technology for Nigeria. This office was to function as a corporate body with a permanent secretary from the Ministry of Finance as its chairman.

Early in 1978, Nigeria announced that it would be withdrawing all State funds from Barclays Bank of Nigeria and ordered a reduction in its foreign staff in protest at the bank's policy towards the Republic of South Africa. It was the first major step to implement Nigeria's new policy of punitive action against companies dealing with the Republic of South Africa. In 1976, Nigeria had ruled that all foreign banks operating there would have to be 60% locally owned. Along with Africanization, there was also increasing Government pressure on banks to adjust lending policies to the state's economic targets.

From late 1977 to about mid-1978, a nationwide brownout was caused by unforeseen low water at Kainji Dam and resulted in daily power shutoffs that affected industry, agriculture, and commerce. Production losses were estimated to total several hundreds of million of dollars. The Kainji Dam hydroelectric plant produced nearly 70% of Nigeria's electric power. The Ministry of Mines and Power and the National Electric Power Authority (NEPA) were reviewing long-term plans to decrease reliance on hydrofacilities and increase use of thermal power using gas and coal.

An extensive cost and design study was completed by Matthew Hall Ortech Ltd. on a national minerals and metallurgical laboratory project for the Jos Plateau State. The Nigerian Federal Ministry of Mines and Power, which awarded the contract to Ortech, was evaluating the result of the study as part of its 5-year development plan.

PRODUCTION AND TRADE

Nigeria's mineral production, excluding petroleum, was valued at $103 million in 1978.[4] Tin, columbite-tantalite, and coal were major contributors. Production and export of petroleum continued to decline through much of 1978. Nigeria's petroleum revenues in 1978 were reported as $9.3 billion compared with $10.6 billion for 1977.[5] The contribution of crude petroleum to total export value declined from 92.6% in 1977 to 91% in 1978. By 1979, however, Nigeria was benefiting from the petroleum shortage triggered by the Iranian crisis; petroleum revenues for 1979 were estimated at $15 billion. With the boost of Nigerian oil prices on January 1, 1980, from $27.26 per barrel to $30, Nigeria was anticipating even higher petroleum export returns in 1980. To alleviate the problem of overpricing that plagued Nigeria in late 1977, Nigeria had lowered petroleum prices by about 30 cents per barrel on January 1, and by another 21 cents early in April 1978. These measures, coupled with the Iranian production dropoff that occurred late in 1978, injected Nigeria's petroleum industry with new incentive and recovery in 1979. Petroleum production averaged 1.8 million barrels per day in 1978, but by December, output had reached 2.3 million barrels per day and a reduction in stocks allowed exports to reach a level of 2.5 million barrels per day. Petroleum production averaged about 2.3 million barrels per day in 1979.

The crisis in the foreign trade sector continued throughout 1978, despite the recovery of petroleum exports late in the year. Imports remained at close to $1 billion per month through the third quarter of the year despite the April 1 ban on imports. Government officials had attributed a large portion of the trade deficit to overinvoicing and other fraud. To remedy this situation, the Government announced a preshipment inspection system was to be instituted on January 1, 1979. Inspection for quantity, quality, and price standards was to be done by a Swiss firm, Société Generale de Surveillance. This procedure, along with other import measures already instituted, was expected to cause more delay and complication to the import process. The banning and licensing of imports had adversely affected wholesale and retail trades as well as Nigerian manufacturers who depended upon imported raw materials. By the second half of 1978, the import measures were beginning to take effect. For example, British exports to Nigeria, worth $208 million in July, were down to $140 million by December 1978. By yearend 1979, with imports cut back and oil production running at record levels, Nigeria appeared to be over the worst of its external foreign exchange and trade difficulties.

The United States, with a 11% share of the Nigerian import market in 1978, continued to rank third as supplier to Nigeria, after the United Kingdom (21.6%) and the Federal Republic of Germany (14.2%). Nigerian crude petroleum accounted for 13% of the total U.S. imports in 1978,[7] compared with 19% in 1977. The share of oil in United Kingdom imports from Nigeria fell from 76% in 1975 to about 38% in 1977, corresponding to the increase of North Sea oil production. United Kingdom imports of Nigerian tin rose only marginally during the same period. Nigeria was the Federal Republic of Germany's largest African export market in 1978, and its third largest source of African imports, after Libya and Algeria.[8] Since 1974, Nigeria's exports to the U.S.S.R. have decreased by about 76% in value; imports from the U.S.S.R. have increased by 250% over the same time span. Nigeria is the U.S.S.R.'s third largest African export market, after Egypt and Algeria.[9] During 1978, discussions were held with Jamaica on trade arrangements in which Jamaica would purchase tin, columbite, and coal and in return would sell bauxite and other items to Nigeria.[10]

Nigeria was considering several barter deals, exchanging oil for goods in order to conserve foreign exchange. Contracts were being renegotiated with both Yugoslavia and the Republic of Korea shipbuilders. In terms of the contracts awarded in 1977, Split of Yugoslavia was to build eight multipurpose vessels for $133 million, and Hundai of South Korea was to supply 11 cargo ships, costing $142 million.[11]

Table 1.—Nigeria: Production of mineral commodiies

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Columbium and tantalum concentrates, gross weight:				
Columbite	708	861	666	520
Tantalite	1	1	1	(1)
Iron and steel: Crude steel	15,000	15,000	15,000	15,000
Lead, mine output, metal content[e]	130	70	50	50
Rare-earth metals: Monazite concentrate[e]	20	20	20	20
Tin:				
Mine output, cassiterite concentrate:				
Gross weight	5,050	4,630	4,011	4,400
Sn content	3,710	3,267	2,751	3,000
Metal, smelter	3,667	3,315	3,045	3,000
Tungsten ore and concentrate, gross weight	(1)	--	--	--
Zinc ore and concentrate, metal content[e]	450	--	--	--
NONMETALS				
Cement, hydraulic thousand tons	1,274	1,440	[e]2,500	1,740
Clays, unspecified	1,000	1,208	[e]1,500	NA
Feldspar[e]	5,000	5,000	5,000	5,000

See footnotes at end of table.

Table 1.—Nigeria: Production of mineral commodiies —Continued

(Metric tons unless otherwise specified)

Commodity		1976	1977	1978[p]	1979[p]
NONMETALS —Continued					
Stone:					
Limestone	thousand tons	[e]1,640	1,243	[e]1,200	[2]2,006
Marble		[e]4,900	6,065	[e]6,000	[2]1,031
Shale	thousand tons	[e]197	[e]165	NA	[2]149
MINERAL FUELS AND RELATED MATERIALS					
Coal	do	312	238	264	[2]172
Gas, natural:					
Gross	million cubic feet	764,000	757,320	721,405	NA
Marketed	do	18,500	17,657	13,420	NA
Petroleum:					
Crude	thousand 42-gallon barrels	756,064	761,025	697,150	[2]841,325
Refinery products:					
Gasoline	do	5,270	6,169	17,749	NA
Jet fuel	do	1,080	964	6,784	NA
Kerosine	do	1,921	1,445	--	NA
Distillate fuel oil	do	5,161	4,891	12,817	NA
Residual fuel oil	do	6,661	3,687	8,427	NA
Lubricants	do	399	--	--	NA
Other, unspecified	do	220	438	9,220	NA
Refinery fuel and losses	do	479	528	1,650	NA
Total	do	21,191	18,122	56,647	57,000

[e]Estimate. [p]Preliminary. NA Not available.

[1]Less than 1/2 unit.

[2]Reported figure.

Table 2.—Nigeria: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal destinations, 1976
METALS			
Columbium and tantalum ores and concentrates	979	1,036	United Kingdom 375; Japan 331; Netherlands 170; United States 130.
Copper matte	--	5	All to West Germany.
Iron and steel metal:			
Scrap	27	336	Belgium-Luxembourg 240; West Germany 60; United Kingdom 36.
Semimanufactures	--	702	All to Netherlands.
Lead ore and concentrate	177	40	All to Belgium-Luxembourg.
Tin:			
Ore and concentrate	250	--	
Metal including alloys, all forms	4,729	3,419	United Kingdom 2,019; Netherlands 1,400.
Uranium ore and concentrate	--	35	All to United Kingdom.
Zinc:			
Ore and concentrate	--	71	Do.
Metal including alloys, all forms	46	--	
Zirconium ore and concentrate	--	3	Netherlands 2; United Kingdom 1.
Other nonferrous base metals:			
Ores and concentrates	365	462	Netherlands 437.
Scrap	1,574	1,526	Netherlands 547; United Kingdom [illegible]; West Germany 311; Belgium-Luxembourg 227.
NONMETALS			
Clays	--	([1])	All to United States.
Fertilizer materials, crude	14	11	All to Togo.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	516	545	Brazil 300; Netherlands 110; United Kingdom 59; West Germany 56.
Coal and coke, including briquets	31,024	10,416	All to Ghana.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	605,371	754,098	United States 275,956; Netherlands Antilles 114,508; Netherlands 74,561.

See footnotes at end of table.

Table 2.—Nigeria: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal destinations, 1976
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum —Continued			
Refinery products:			
Gasoline thousand 42-gallon barrels	77	216	United States 136; Equatorial Customs Union[2] 54; Niger 19.
Kerosine do.	19	96	Equatorial Customs Union 73; Bénin 21.
Jet fuel do.	110	65	Equatorial Customs Union 51; São Tomé and Principe 7.
Distillate fuel oil do.	443	380	Niger 147; Equatorial Customs Union 134; ship stores 76.
Residual fuel oil do.	2,196	4,329	United States 4,123.
Lubricants do.	7	12	Ship stores 9; Bénin 1; Equatorial Customs Union 1.
Bitumen and bituminous mixtures, n.e.s. do.	1	148	Netherlands 124; Spain 23.
Total do.	2,853	5,246	

[1] Less than 1/2 unit.

[2] Consists of the Central African Empire, Chad, the Congo, and Gabon.

Table 3.—Nigeria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
METALS			
Aluminum metal including alloys:			
Unwrought	3,298	5,334	Canada 3,004; West Germany 1,194; Norway 786.
Semimanufactures	16,315	12,127	Switzerland 3,726; United Kingdom 3,102; West Germany 1,555.
Copper metal including alloys:			
Unwrought	4	102	Canada 61; Sweden 19; United Kingdom 10.
Semimanufactures	2,960	4,535	United Kingdom 1,792; West Germany 1,386.
Iron and steel:			
Ore and concentrate, including roasted pyrite	16	1,944	Sweden 1,919.
Metal:			
Scrap	40	491	Ivory Coast 460.
Pig iron, including cast iron	97	31	United Kingdom 16; West Germany 15.
Sponge iron, powder, shot	714	21	United Kingdom 11; Netherlands 6; France 2; United States 2.
Spiegeleisen	25	71	All from United Kingdom.
Ferroalloys	745	--	
Steel, primary forms	73,519	90,339	West Germany 31,789; United States 10,313; Italy 10,186.
Semimanufactures	1,135,781	1,403,846	Japan 482,542; United Kingdom 278,004; West Germany 261,825.
Lead metal including alloys:			
Unwrought	115	154	United Kingdom 130; Netherlands 19.
Semimanufactures	225	177	United Kingdom 110; West Germany 56.
Nickel metal including alloys:			
Unwrought	10	(1)	All from Czechoslovakia.
Semimanufactures	190	19	China, mainland, 11; West Germany 3; United Kingdom 2.
Platinum-group metals and silver:			
Ores and concentrates	42	2	All from France.
Metals including alloys, all forms:			
Platinum-group troy ounces	1,802	1,813	United Kingdom 1,619.
Silver do.	351	1,262	United Kingdom 1,092; West Germany 170.
Tin metal including alloys:			
Unwrought	63	978	Zaire 641; Belgium-Luxembourg 225; United Kingdom 112.
Semimanufactures	201,982	347	Hong Kong 260; United Kingdom 86.
Uranium and thorium ores and concentrates	22	--	
Zinc metal including alloys:			
Unwrought	10,116	9,961	Zaire 3,517; Belgium-Luxembourg 2,867; West Germany 1,599.
Semimanufactures	758	172	Finland 69; Zaire 36; West Germany 22; United Kingdom 19.
Other:			
Ores and concentrates of base metals	280	36	Sweden 28; United Kingdom 7.
Nonferrous metals including alloys, all forms	11,162	9,497	Zaire 5,932; Canada 1,267.

See footnotes at end of table.

Table 3.—Nigeria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
NONMETALS			
Abrasives:			
Natural	1,768	664	United States 381; United Kingdom 81.
Grinding and polishing wheels and stones	415	1,233	United Kingdom 644; Italy 301; Hong Kong 104.
Asbestos	29,024	55,258	Canada 26,722; West Germany 10,292; Italy 7,373; Switzerland 5,500.
Cement, hydraulic	1,737,542	1,988,219	Spain 355,386; Greece 291,540; Italy 258,855; West Germany 212,565.
Clays and clay products (including all refractory brick)	28,090	27,619	Italy 6,992; West Germany 5,714; United Kingdom 3,839; Spain 2,804.
Diamond, industrial value, thousands	$15	$46	Mainly from India.
Fertilizer materials:			
Crude	26,766	427,791	United States 368,014.
Manufactured:			
Nitrogenous	82,308	90,814	United States 49,161; West Germany 30,551; Netherlands 9,484.
Phosphatic	62,588	99,098	Belgium-Luxembourg 21,025; Netherlands 16,809; West Germany 15,982.
Potassic	4,604	5,762	West Germany 3,657; Netherlands 2,105.
Other	1,462	12,183	Japan 7,000; West Germany 3,419; Togo 1,250.
Ammonia	2,865	690	United Kingdom 372; West Germany 111; Netherlands 75.
Lime	20,863	17,576	United Kingdom 17,311.
Mica, all forms	87	106	Italy 86; United Kingdom 11.
Pigments, mineral, including processed iron oxides	4,161	6,762	United Kingdom 4,858; Belgium-Luxembourg 642.
Precious and semiprecious stones, except diamond[2] value, thousands	$1,184	$1,556	Mainly from India.
Salt, excluding brine	199,466	289,859	United Kingdom 170,499; Poland 23,387.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	27,918	24,388	West Germany 11,656; United Kingdom 5,752; United States 3,549.
Caustic potash and sodic and potassic peroxides	6,604	6,751	United Kingdom 3,892; France 1,170; West Germany 777.
Stone, sand and gravel:			
Worked	13,237	1,111	Italy 551; Norway 245; United Kingdom 157; West Germany 105.
Gravel and crushed rock	19,105	3,646	United Kingdom 1,195; Togo 984; Niger 406; West Germany 396; United States 348.
Sulfur, all types, other than sublimed	543	865	United Kingdom 464; West Germany [illegible]
Other:			
Crude	7,827	1,145	United Kingdom 611; United States 407.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	117,595	444,620	Italy 264,398; United Kingdom 43,140; Spain 40,069.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	143,208	175,297	Bénin 62,967; Norway 32,069; German Democratic Republic 16,900.
Coal and coke, including briquets	8,571	5,352	United Kingdom 4,216; West Germany 1,010.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	4,317	6,754	Italy 2,148; Netherlands 1,158; United Kingdom 862.
Kerosine do	675	1,983	Netherlands Antilles 544; France 446; Italy 225; Cameroon 219.
Jet fuel do	947	679	United Kingdom 133; Netherlands 119; France 102.
Distillate fuel oil do	1,717	2,637	Netherlands 541; United Kingdom 465; Italy 358.
Residual fuel oil do	150	60	France 15; Italy 15; Netherlands 9.
Lubricants do	393	575	United Kingdom 178; Netherlands 98; United States 67; France 65.
Mineral jelly and wax do	52	72	Netherlands 25; United Kingdom 18; Italy 15; United States 12.
Bitumen and bituminous mixtures, n.e.s do	736	4,598	West Germany 1,864; Netherlands 1,137; United Kingdom 904.
Other do	23	9	United Kingdom 5; France 1; Netherlands 1; United States 1.
Total do	9,010	17,367	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	77,219	11,249	Netherlands 9,936.

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[1] Less than 1/2 unit.

[2] Includes pearls.

COMMODITY REVIEW

METALS

Columbite.—After an increase during 1978, columbite concentrate production slumped by 23% to 666 tons, following the suspension of operations at the Odegi mine by Vectis Tin Mines Ltd. In 1978 and 1979 the principal sources of columbite were Amalgamated Tin Mines of Nigeria, which produced over 40%, and Bisichi-Jantar Ltd., which produced between 49% (1978) and 68% (1979) of the total. Bisichi-Jantar produced 354.14 tons of columbite in 1979 compared with 329.19 tons in 1978. Gold and Base Metals Ltd. produced less than 1% of the columbite concentrates. Mining and processing continued to be influenced by rising costs exacerbated by lower tin prices early in 1978 and by the failure of columbite prices to respond to the rise in value of their tantalum content. The columbite market gained strength during 1979 largely owing to increased demand, with 1979 columbite prices at $10.30 per pound compared with $3.45 per pound in November of 1978.

Iron and Steel.—In June 1979 Nigeria and representatives of the Soviet company Vsesojuznoje Exportne-Inportnoje Tiajpromexport initialed a draft agreement for the iron and steel complex at Ajaokuta, Kwara State. Pilot mining of iron ore also started in the Itakpe Hills. Nigerian authorities were negotiating with Brazil and Liberia for the supply of up to 1.5 million tons of iron ore to be used in the direct reduction plants scheduled for construction by 1982 at Warri. A loan of $1,126 million was arranged in 1979 for financing the Warri steel project with a group of West German and Austrian banks. To be called the Delta Steel Complex, the Warri project includes a harbor and plant that will produce 1.3 million tons per year of raw steel using a Midrex direct reduction process. The direct reduction plant will be fed from a pellet plant (1.4 million tons per year) to be built by Voest—Alpine of Austria. Contracts were also signed for three rolling mills, to be situated at Oshogbo, Jos, and Katsina. Kobe Steel Ltd. of Japan (Katsina) and Eisenbau Essen Gmbh (Oshogbo), Aktiengesell Schaft (Jos), and Mannesmann Demag (Jos) of the Federal Republic of Germany were the contractors.

Tin.—Net income at Amalgamated Tin Mines of Nigeria (Holdings) (ATMN) of London dropped during 1978 and 1979. The slippage was explained mostly by the inflationary costs for mining and a lower level of production, which was only 2,020 tons tin concentrate for fiscal year 1978 and 1,870 tons in 1979 compared with 4,630 tons for the same 1977 period. The company's operating subsidiary was now 60% owned by Nigerian interests, primarily the state-owned Nigerian Mining Corporation (NMC). ATMN produced about 50% of the Nigerian tin production; other producers included Bisichi Jantar (9%), Gold and Base Metals (13%), and Exlands Nigeria (13%). Kaduna Syndicate, United Tin areas Ltd., and Vectis Tin Mines Ltd. also produced small amounts. Kaduna Prospectors was a subsidiary of Mining Investment Corporation of the United Kingdom, which had interests in tin mining in both Nigeria and Cornwall and was recently (1977) named the Selukwe Gold Mining and Finance Company. Bisichi-Jantar produced 291.4 tons of tin concentrate in 1979, compared with 347.9 tons in 1978. ATMN lost over 6 months' production in 1978 when the bucket wheel excavator in the company's new deep pit failed to cope satisfactorily with handling of overburden and the instability of the ground being worked. Even so, ATMN had demonstrated that the problems encountered in opencast mining at depths of over 150 feet were not insurmountable. A group of experts were commissioned to study possible methods of solving the mining problems encountered. The unstable ground conditions stemmed from a water-saturated sand layer located 30 feet below the surface. The consultants recommended installation of a drainage system. Prospecting of ATMN's subbasalt ore reserve areas revealed 6,000 tons of tin concentrate, which were being considered for exploitation. Gold and Base Metal Mines retained an interest in the Rirewai underground mine through its 40% holding in the Nigerian subsidiary.

Makeri Smelting Co., Ltd., operated the tin smelter at 25% of capacity during 1978 and reported a 10% drop in refined tin processed. The company installed a small secondary lead smelter and refinery which would use motor car battery cells for raw material. The lead and antimony recovered would supply Makeri's own needs for production of solder and printing metal materials. The new project would also keep the tin smelter crews employed during slow periods.

Uranium.—An agreement was signed by the Ministry of Mines and Power and the French Bureau de Recherches Geologiques et Minieres (BRGM) under the auspices of the Nigerian Uranium Company (NUMCO), for uranium prospecting in the Gombe area of Bauchi State. NUMCO was incorporated in Nigeria with NMC having 60% of the shares and Minatome of France holding 40%.

NONMETALS

Building Materials.—A new brick plant was established in Isiwo, Ogun State. The factory, owned by Patrick George and Sons Ltd., produces red brick and colored terrazzo tile. Its initial output of 45,000 brick per day was to be raised to 60,000. The industry used local raw materials, including clay and sand, for the brick, although the coloring pigment was imported. Two other similar plants were located in Anambra and Borno States.

Cement.—A number of large French banks were instructed by a Paris court to block Nigerian bank accounts because of the continued failure of Nigeria to settle a debt for cement dating from 1975. In 1975 the Nigerian Central Bank apparently issued irrevocable letters of credit for the payment, but canceled them after shipment. Subsequently, Nigeria agreed to a private settlement payment for the cement.[12]

With expansion of construction activities and the resultant growth in demand for cement, the domestic output of cement has steadily increased in recent years. Total domestic output of cement was estimated at nearly 2.5 million tons, and plans were underway for expanding existing plants and building new ones. In addition, Nigeria was to take part in a joint venture cement complex in Benin as a result of the Economic Community of West African States (ECOWAS) decision for coordinated investment within member States. Demand for cement was estimated to be nearly 7 million tons in 1978. By January 1980, because of a slump in construction projects, the Nigerian National Supply Company declared a surplus of cement and prices were reduced from $114 to $98 per ton of cement.[13] Beginning April 1, 1979, an advance deposit of 50% would be required for all cement imports.

The West African Portland Cement Company (WAPCC), a Blue Circle Group subsidiary, officially opened its second cement plant on May 5, 1978, at Shagamu near Lagos, although production had started by yearend 1977. The new plant had a 650,000-ton-per-year capacity. During the construction period, more than 30,000 tons of plant and machinery were imported, and at its peak, more than 2,000 people were employed on the project. The works at Shagamu was designed to eventually use six kilns, of which only two were installed in 1979. WAPCC's plant at Ewekoro, near Lagos, had three kilns and a production capacity of 750,000 tons per year. A loan agreement for $22.5 million was signed in 1978 for additional extension to the cement works at Shagamu. Turners Building Products Ltd. was investing $7.8 million to double their plant's asbestos cement production. A new $14 million asbestos cement manufacturing plant was established in Bauchi State with production scheduled for 1980. Sited near Gombe, the plant would be a jointly owned project including Hyderabad Asbestos of India (35%) and the Nigerian Bank of Commerce and Industry and Nigerian Industrial Development Bank. A 10% share would also be reserved for interested local businessmen.

Fertilizer Materials.—*Phosphate Rock.*—Federal Superphosphate Fertilizer Co. (FSF) produced 22,100 tons of single superphosphate in 1978, well below the plant's capacity of 100,000 tons. The low production was attributed to erratic supplies of electricity and phosphate rock. Togo was FSF's sole source of phosphate rock. The FSF plant located at Kaduna came onstream in 1975.

MINERAL FUELS

Coal.—In recent years the Nigerian Coal Corporation (NCC) had spent about $50 million on improved coal mining mechanization. NCC was then faced with a problem of finding markets for the expected increased production. Ghana was reportedly the only country importing coal from Nigeria. In 1975, coal exports went also to Egypt and the Federal Republic of Germany. Sales of Nigerian coal had been dropping since the peak production year of 1972 when 341,000 tons had been produced. By yearend 1978, NCC had on hand approximately 59,000 tons of unsold coal which had accumulated since 1976. For 1976, the unsold figure was reported at 18,485 tons, and for 1977, as 26,873 tons. The mechanization of the Enugu mines was being done since 1976 by Katowic Arebowa (KOPEX) of Poland. To date, two of the four scheduled mines were fully equipped for longwall mining.[14] Construction was also started on the Onne River coal port.

Natural Gas.—A consortium comprising Phillips Petroleum (7.5%), Shell Oil Co. (10%), Azienda Generale Italiani Petroli S.p.A. (AGIP) (7.5%), Elf-Nigeria (5%), and the Nigerian National Petroleum Corporation (NNPC) was proceeding with studies relating to the construction of a 1,600-million-cubic-foot-per-day liquefaction plant at Bonny Island. The plant would be supplied with associated gas that was being flared, as well as from gas-only fields already discovered but not producing. The project will necessitate the construction of a pipeline system in difficult terrain. The state expected to participate in the pipeline project up to 85% with a partner as yet unnamed. The Government was to also take 50% share in the shipping facilities. Contracts for purchase of the LNG were to be negotiated with several U.S. companies.

The Government was going ahead with the billion-dollar petrochemical complex at Port Harcourt which was to produce vinyl chloride monomer (VCM), polyvinyl chloride (PVC), caustic soda, chloride, high-density polyvinyl (HDPE), and low-density polyethylene (LDPE). Technimont, subsidiary of the Montedison Group, was to build the $80 million plant. Production was to begin in 1982. By yearend 1979, an agreement had been reached with Pullman-Kellogg of the United States for construction of a fertilizer complex at Port Harcourt. The $340 million complex was to produce 1,000 tons per day of ammonia, 1,500 tons per day of urea, and 1,000 tons per day of compound fertilizer (NPK). It will use nearly 1 billion cubic feet per day of natural gas. Two U.S. companies, Transcontinental Fertilizer and International Minerals and Chemical Corp, will help market the products.

Petroleum.—*Production.*—As of January 1, 1978, Nigeria held 4.3% of the Organization of Petroleum Exporting Countries' (OPEC) total crude petroleum reserves. Estimated proven recoverable reserves were given as 18.7 billion barrels. In 1979 the state-owned NNPC increased its holdings in the main producing groups to 60% and was acting as the Government's regulatory authority for the oil industry. Nigeria also nationalized all of British Petroleum's Nigerian crude oil interests. This included the 20% stakes in the Port Harcourt Refinery and Shell-BP. Development Company as well as the 60% share in the BP Nigeria Ltd. Marketing Company. Shell-BP Development Company of Nigeria was 20% owned by Shell and 80% by NNPC. NNPC was to be reorganized into several companies with NNPC serving as holding company. The five companies proposed were Crude Sales, Petrochemicals, Refineries, National Tanker Fleet, and National Gas Companies. Each company will have a chairman, board members, and general manager.

Following expiration of long-term purchasing agreements at yearend 1977, Nigerian oil production slumped to the lowest point in over six years by March 1978. Three of the largest producers were operating at only 60% of capacity. The 1978 yearly average of 2,098,000 barrels per day, down from the average of 2,098,000 barrels per day achieved in 1977. The increase began in April and continued through the year after price reductions were announced. Official price reductions helped bring about a turnaround in Nigerian oil output for 1978. Nigeria announced reductions of 21 to 23 cents per barrel on its main crudes, with second-quarter prices as follows (excluding 2 cents per barrel harbor dues): 42% API Brass River, $14.13 (down 23 cents); 37% API Forcados, $13.80; 26% API medium, $13.60. The market dislocations caused by the Iranian production dropoff in late 1978 and early 1979 were eventually to support price hikes of much greater magnitudes. By yearend 1979, Nigeria's crude oil was priced at $26.27 per barrel for Brass River Blend. Crude petroleum production was scheduled to be cut in 1980 by about 10% from earlier record 1979 rates of 2.4 million barrels per day.

Exploration.—The Shell-British Petroleum (BP) Development Company of Nigeria had three seismic teams under permanent contract and had increased seismic surveys and exploratory drilling by 40% over 1977. Gulf was employing four drilling rigs on and off shore in 1978, three of which were exploratory operations. Gulf's 1979 exploration budget was $215 million. NNPC was contracting the largest number of seismic teams with one party working in the Chad Basin,one in Anambra, and two in the Niger Delta. NNPC was expecting to offer new exploration and production licenses on areas outside the existing concessions on terms related to the situation of each area. All interested companies were to be considered, not just the operating companies.

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After expiration of its contract, Japan's Nigeria Oil withdrew even though it made finds at 6 of its 18 offshore wells. Reserves in this area, estimated at 30 million barrels, were considered noncommercial under 1978-79 production terms. Italy's AGIP, the Spanish-state-owned Hispanoil, and the Crown Central oil company all signed new exploration contracts under NNPC's new terms. AGIP was to carry all risks in exchange for 50% of production from commercial finds to cover expense, investment, and profit. If this oil does not cover cost, NNPC will sell additional oil to AGIP at market price in addition to 50% of production. Hispanoil's and Crown Central's agreements were described as service contracts. AGIP was to develop its Nembe Creek discovery at an output of 60,000 barrels per day. AGIP's Utapate South discovery was also under development.

Texaco Overseas (Nigeria) tested the Funiwal-1 well at 1,007 barrels per day in the offshore block held by NNPC (55%), Chevron Oil Co. (Nigeria) (22.5%) and Standard Oil of California (22.5%). The find occurred in water 40 feet deep, 6 miles offshore. A new offshore field was also discovered by AGIP on the OML-62 area of the Niger Delta. The crude was 28.3% API from deeper levels and 20.3% API from upper levels in the Beniboye North-1 discovery well. The well tested a maximum flow of 3,100 barrels per day.

Refining.—Nigeria's new refinery at Warri started production on September 19, 1978. Constructed by the Italian company Snamprogetti, the Warri refinery was stopped temporarily in December a few months after its startup because of technical difficulties. With a crude petroleum capacity of 100,000 barrels per day, the new refinery was designed to process crude from Shell-BP's Ughelli blending station and from Gulf's Escravos terminal. A full range of products were being produced with facilities capable of producing a high proportion of light products for the local market. Refined products were to be distributed though a 3,000-kilometer network of pipelines and 19 storage facilities still under construction. Including the Port Harcourt refinery, which had a 60,000-barrel-per-day capacity, the total national refined product output was expected to be 43.8 million barrels per year. Current consumption, running at 67.5 million barrels per year was increasing at about 25% annually. The third refinery (100,000 barrels of crude oil per day) under construction at Kaduna was expected to be operational by 1980.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Nigerian naira (N) to U.S. dollars at the rate of N1.00=US$1.56 for 1978 and at the rate of N1.00=US$1.75 for 1979.

[3] The Financial Times (London). Nigeria Sets 10% Tax Hurdle for Foreign Airlines and Shipping. July 17, 1978, p. 1.

[4] The Financial Times (London). Black Africa Towards Local Control. May 30, 1978, p.31.

[5] U.S. Embassy, Lagos, Nigeria. Department of State Airgram A-57, July 31, 1979, 13 pp.

[6] International Monetary Fund (Washington, D.C.). International Financial Statistics. V. 32, No. 3, March 1979, pp. 280-283.

[7] Petroleum Economist. U.S. Crude Oil Imports, Rise Confirmed. V. 46, No. 3, p. 90.

[8] Marches Tropicaux et Mediterraneens (Paris). West German Aid Detailed. May 18, 1979, pp. 1235-1236.

[9] Marches Tropicaux et Mediterraneens (Paris). Soviet-African Trade Statistics Detailed. May 25, 1979, pp. 1292-1293.

[10] Mining Journal (London). Jamaica - Nigeria Commodities Agreement. Oct. 27, 1978, p. 332.

[11] The Financial Times (London). Oil Barter Negotiations. June 28, 1978, p. 6.

[12] The Financial Times (London). Nigerian Accounts Blocked in (Paris). Oct. 7, 1978, p. 28.

[13] Business Times (Lagos). Cement Surplus. Jan. 15, 1980, p. 20.

[14] Business Times (Lagos). Coal Industry Prospects Discussed. Apr. 24, 1979, p. 32.

The Mineral Industry of Norway

By Joseph B. Huvos[1]

In 1978 and 1979, financial restrictions to improve Norway's international competitiveness were further tightened, including a wage and price freeze, reduced credit supply, reduced industry support, and reduced public spending. As a result, Norway had a trade surplus. The country's minerals industry, mainly hydropower-based aluminum, ferroalloys, copper, and zinc, remained in a slump with the exception of oil and gas, the production of which expanded, making Norway a net exporter of these commodities. In 1979, Norway's gross national product (GNP) was about $42 billion.[2] The average unemployment rate was about 1.6%.

There were only a few important events in Norway's mineral industry in 1978 and 1979. In the North Sea, production started at the Thor oilfield, and development drilling was begun at the Statfjord A platform. Oil and gas were discovered in blocks 31/2, 30/6, 34/10, 15/5, and 1/9-3. Construction was completed at LKAB's Narvik iron ore loading port and continued at Elkem's Bremanger silicon smelter. Construction started at Norsk Jernverk's Rana Gruber iron ore concentrator. Finally, a decision was made to close three more copper mines.

PRODUCTION

In 1978 and 1979, change in production of most mineral industry products was not significant, but oil and gas expanded substantially. Production of major mineral commodities in Norway in 1976, 1977, 1978, and 1979 is shown in table 1.

Table 1.—Norway: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum metal:				
Primary ingot	617,579	628,285	639,757	[1]673,456
Secondary ingot	14,915	[e]15,000	NA	NA
Superpure	4,700	4,700	4,700	NA
Cadmium metal, smelter	80	97	120	110
Cobalt metal	576	705	522	[1]953
Copper:				
Mine output, metal content of concentrate	31,080	29,501	28,348	[1]28,015
Metal:				
Smelter, primary only	23,393	26,575	20,056	[1]27,357
Refined:				
Primary	17,757	19,976	14,523	[1]20,964
Secondary	6,217	[e]6,600	[e]5,600	6,000
Total	23,974	26,576	20,123	26,964

See footnotes at end of table.

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Table 1.—Norway: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS —Continued				
Iron and steel:				
Iron ore and concentrate thousand tons	3,972	3,635	3,775	[1]4,243
Roasted pyrite do.	155	147	[e]140	110
Pig iron do.	656	512	556	[1]654
Ferroalloys:				
Ferrochrome do.	31	22	15	[1]12
Ferrochromium silicon do.	1	(2)	1	[1]1
Ferromanganese do.	349	244	276	[1]338
Ferrosilicon (75% basis) do.	278	223	269	[1]349
Silicon metal do.	57	51	63	70
Ferrosilicomanganese do.	168	127	135	[1]180
Other do.	31	31	6	[1]7
Total do.	915	698	765	957
Steel, crude do.	909	711	812	[1]924
Semimanufactures:				
Rolled do.	666	500	644	NA
Finished castings do.	14	10	4	NA
Lead:				
Mine output, metal content	3,861	3,265	3,561	3,000
Smelter, secondary only[e]	600	900	300	400
Magnesium metal, primary	38,808	38,165	39,150	45,000
Nickel:				
Concentrate, metal content	525	500	1,000	500
Metal, primary	32,685	38,223	23,737	30,700
Platinum-group metals[3] troy ounces	48,676	39,867	33,630	NA
Titanium:				
Ilmenite concentrate	766,664	828,508	767,033	770,000
Dioxide[e]	25,000	NA	NA	NA
Vanadium, mine output, metal content[e]	530	540	460	460
Zinc:				
Mine output, metal content	[r]29,054	30,323	28,889	29,000
Metal, primary	64,352	69,790	71,628	[1]77,455
NONMETALS				
Cement, hydraulic thousand tons	2,686	2,333	2,150	[1]2,197
Feldspar, lump[4]	37,690	70,799	71,000	71,000
Graphite	9,071	9,097	10,118	10,900
Lime, hydrated and quicklime	90,243	[e]100,000	100,000	100,000
Mica[5]	3,088	2,818	2,810	2,800
Nitrogen: N content of ammonia	473,333	504,521	526,458	545,000
Olivine sand	529,291	350,635	606,087	NA
Pyrite and pyrrhotite, gross weight	367,588	308,663	296,784	290,000
Sodium and potassium compounds, n.e.s.:				
Caustic soda	74,605	73,885	79,142	76,000
Sodium carbonate[e]	23,000	25,000	26,000	24,000
Stone:				
Dimension stone: Slate	51,535	58,941	NA	NA
Crushed and broken:				
Dolomite:				
Ground	NA	66,175	80,322	NA
Not further described	467,346	512,040	510,681	NA
Limestone thousand tons	[r]5,189	4,607	4,390	NA
Nepheline syenite	216,607	209,689	231,273	242,465
Quartz and quartzite	724,029	600,676	672,744	NA
Other thousand tons	[e]1,106	NA	NA	NA
Sulfur:				
Pyrite, S content do.	188	158	152	150
Byproduct of:				
Metallurgy do.	33	38	36	40
Petroleum do.	7	7	7	6
Total do.	228	203	195	196
Sulfuric acid (100%)	405	388	384	NA
Talc, soapstone, steatite:				
Unground	50,639	33,564	NA	NA
Other	67,572	64,523	NA	NA
Total	118,211	98,087	[e]110,000	110,000
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades	524,729	436,784	402,084	250,250
Coke, all grades	282,562	317,184	309,015	335,000

See footnotes at end of table.

Table 1.—Norway: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued				
Gas:				
Manufactured million cubic feet	895	729	579	527
Natural:				
Gross do.	110,000	160,000	550,000	NA
Marketed do.	(6)	92,401	511,482	NA
Peat:[4]				
For agricultural use	60,000	60,000	60,000	70,000
For fuel use	1,100	1,100	1,100	900
Petroleum:				
Crude thousand 42-gallon barrels	101,900	101,887	127,163	280,000
Refinery products:				
Gasoline, motor do.	8,915	10,030	7,490	NA
Jet fuel do.	1,715	2,446	1,762	NA
Kerosine do.	1,299	2,219	2,807	NA
Distillate fuel oil do.	25,566	20,657	23,728	NA
Residual fuel oil do.	17,534	17,023	11,674	NA
Lubricants do.	59	287	33	NA
Other do.	5,525	5,361	1,721	NA
Refinery fuel and losses do.	2,923	4,215	5,981	NA
Total do.	63,536	62,288	55,196	NA

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] Reported figure.

[2] Less than 1/2 unit.

[3] Data represent exports.

[4] Excludes nepheline syenite, which is included under "Stone."

[5] Excludes a quantity of stone reported at 4,774,485 cubic meters.

[6] A small quantity may have been used for fuel in the fields, but there was essentially no marketed production.

TRADE

In 1979, Norway's trade deficit changed to a surplus. Exports increased substantially due to increased crude oil and natural gas production, but imports changed little. There was no change in the general pattern of Norway's mineral trade, which consisted mainly of imports of raw materials for the electric smelters and exports of petroleum and finished metals. Norway's mineral commodity trade in 1977 and 1978 is shown in tables 2 and 3.

Table 2.—Norway: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Alumina	1	1	NA.
Metal including alloys:			
Scrap	14,704	21,520	West Germany 10,656; Brazil 4,769; Sweden 2,504.
Unwrought	555,263	630,241	West Germany 168,622; United Kingdom 130,887; United States 68,361.
Semimanufactures	43,854	56,826	United Kingdom 15,970; United States 9,739; Sweden 7,940.
Cadmium	81	97	NA.
Cobalt	677	559	NA.
Copper:			
Ore and concentrate	98,728	98,239	West Germany 67,913; Sweden 27,494.
Oxide and hydroxide	3,122	2,752	NA.
Metal including alloys:			
Scrap	2,673	4,221	West Germany 2,671; Sweden 726; Belgium-Luxembourg 396.
Unwrought:			
Unrefined	6,841	5,586	West Germany 5,586.
Refined	20,684	16,201	West Germany 4,741; Sweden 3,415; France 3,345.
Semimanufactures	2,104	1,815	Sweden 901; West Germany 436.

See footnotes at end of table.

Table 2.—Norway: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Gold metal, unworked or partly worked troy ounces	8,198	5,112	Denmark 1,640; Italy 1,286; United Kingdom 836.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	2,696	3,074	West Germany 1,154; United Kingdom 973.
Roasted pyrite	43,601	48,047	West Germany 35,789; Denmark 7,280.
Metal:			
Scrap	14,124	36,146	West Germany 21,041; Sweden 7,147; Netherlands 3,934.
Pig iron, including cast iron	88,204	106,518	United Kingdom 35,619; West Germany 19,973; Switzerland 19,156.
Ferroalloys:			
Ferromanganese	201,779	218,863	United States 35,037; West Germany 30,005; Sweden 29,664.
Other	418,817	561,156	West Germany 125,524; United Kingdom 114,117.
Steel, primary forms	149,805	217,526	Netherlands 136,843; Iran 43,335; United Kingdom 22,547.
Semimanufactures:			
Bars, rods, angles, shapes, sections	137,126	184,553	Sweden 47,038; United Kingdom 43,918; West Germany 24,760.
Universals, plates, sheets	142,090	128,788	Sweden 38,352; United Kingdom 38,397; Denmark 23,235.
Hoop and strip	5,306	3,886	Denmark 2,070; Sweden 1,781.
Rails and accessories	19	1,853	U.S.S.R. 974; West Germany 800.
Wire	5,662	7,230	United Kingdom 1,994; Iran 1,030; Portugal 909.
Tubes, pipes, fittings	44,314	34,640	United Kingdom 2,326; United States 2,098; Japan 1,159.
Castings and forgings, rough	7,336	NA	
Total	341,853	360,950	
Lead:			
Ore and concentrate	5,846	4,432	Netherlands 2,269; West Germany 2,163.
Oxides	47	38	Singapore 14; Libya 10.
Metal including alloys:			
Scrap	6,687	6,303	Denmark 3,756; West Germany 1,255; Sweden 1,166.
Unwrought	90	36	Sweden 17.
Semimanufactures	63	11	All to Denmark.
Magnesium metal including alloys:			
Unwrought value, thousands	$75,172	$72,903	NA.
Wrought	136	70	West Germany 57; Netherlands 5.
Manganese ore and concentrate	950	--	
Nickel:			
Ore and concentrate	14,222	12,212	All to Finland.
Metal including alloys:			
Scrap	453	562	West Germany 450; Austria 80.
Unwrought	20,732	40,854	United States 23,457; West Germany 4,489; Netherlands 3,025.
Semimanufactures	4	5	Denmark 4.
Platinum-group metals and silver:			
Waste and sweepings kilograms	29,931	36,446	West Germany 27,105; United Kingdom 9,341.
Metals including alloys:			
Platinum-group troy ounces	39,867	33,630	United States 13,793; United Kingdom 12,796; Netherlands 4,694.
Silver do	1,188,451	773,771	Sweden 576,366; Denmark 98,542.
Rare-earth metals, oxides	9	12	United States 8; Japan 3.
Silicon, elemental	49,982	63,006	U.S.S.R. 15,280; West Germany 12,653; United Kingdom 11,680.
Tin metal including alloys:			
Scrap	61	48	United Kingdom 22; Denmark 15.
Unwrought	99	59	Sweden 43; Finland 15.
Semimanufactures	8	3	Finland 2.
Titanium:			
Ore and concentrate (ilmenite)	723,543	714,108	NA.
Oxides	858	1,133	Sweden 921; Denmark 180.
Tungsten metal including alloys, all forms value	--	$6,867	NA.
Zinc:			
Ore and concentrate	17,717	12,242	Poland 9,394; West Germany 1,381.
Oxide	625	455	Denmark 223; Sweden 212.

See footnotes at end of table.

Table 2.—Norway: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Zinc —Continued			
Metal including alloys:			
Scrap	395	871	West Germany 213; Belgium-Luxembourg 208; United Kingdom 207.
Blue powder	3,574	4,599	NA.
Unwrought	60,617	57,029	Sweden 18,462; United Kingdom 17,136; West Germany 11,037.
Semimanufactures	3,911	5,026	NA.
Other:			
Ash and residue containing nonferrous metals	117,478	124,321	West Germany 87,872; Denmark 23,517.
Metalloids	5	7	Netherlands 3; United Kingdom 3.
NONMETALS			
Abrasives, natural, n.e.s.:			
Grinding and polishing wheels and stones	656	754	Poland 134; Sweden 130; Finland 128.
Asbestos	--	9	NA.
Barite and witherite	13,228	4,627	United Kingdom 3,957; Ireland 646.
Cement, hydraulic thousand tons	755	607	Ghana 261; United States 214; Liberia 90.
Chalk	3	4	NA.
Clays and clay products (including all refractory brick):			
Crude	196	*25	NA.
Products:			
Refractory (including nonclay brick)	4,684	3,719	West Germany 1,567; Sweden 770.
Nonrefractory value, thousands	$2,481	$1,987	West Germany $1,823.
Diamond, gem, not set or strung do	$23	$164	Sweden $134; Denmark $13.
Diatomite and other infusorial earth	75	45	Finland 31.
Feldspar and related materials	270,729	312,715	West Germany 78,545; United Kingdom 72,856; Netherlands 66,777.
Fertilizer materials:			
Manufactured:			
Nitrogenous value, thousands	$60,807	$69,259	NA.
Phosphatic	12	2	NA.
Potassic	--	3,678	All to Sweden.
Other value, thousands	$76,406	$106,003	NA.
Ammonia do	$12,484	$10,338	NA.
Graphite, natural	9,147	10,870	NA.
Gypsum and plasters	11,499	693	Liberia 615; Netherlands 76.
Lime	102	222	Ivory Coast 152.
Mica, crude, including splittings and waste	2,818	2,688	Netherlands 611; Portugal 343; West Germany 316.
Pigments, mineral: Processed iron oxides	79	102	Netherlands 45; United Arab Emirates 23; Singapore 18.
Precious and semiprecious stones, except diamond value, thousands	$11	$2	NA.
Pyrite, gross weight	59,623	63,139	Sweden 60,251.
Salt	1,765	1,863	Sweden 1,328; Denmark 459.
Sodium and potassium compounds, n.e.s value, thousands	$378	$1,697	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous stone	2,144	1,380	Italy 897; West Germany 142.
Slate	48,060	46,822	Netherlands 26,019; West Germany 8,834.
Other	91,352	95,410	France 34,123; West Germany 23,928; Italy 22,320.
Worked, all types	193	234	Sweden 159; Netherlands 45.
Dolomite	121,253	115,250	NA.
Gravel and crushed rock thousand tons	1,159	1,604	West Germany 833; Denmark 208; United Kingdom 205.
Limestone (except dimension)	40,515	42,999	Denmark 37,198; United Kingdom 2,754.
Quartz and quartzite	4,999	2,408	West Germany 1,179; Denmark 540; United Kingdom 358.
Sand, excluding metal bearing	237	4,364	NA.
Sulfur:			
Elemental	442	2,298	Denmark 1,286; United Kingdom 600.
Sulfur dioxide	3,763	--	
Sulfuric acid value, thousands	$2,452	$2,802	NA.
Talc, steatite, soapstone, pyrophyllite	60,771	59,166	United Kingdom 15,302; West Germany 12,018; Netherlands 6,348.
Other:			
Crude	1	16	NA.
Slag, dross, and similar waste, not metal bearing	1,400	1,973	Sweden 1,650; West Germany 279.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	13,554	4,380	Denmark 4,192; Sweden 158; Iceland 23.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	23	1,423	Denmark 1,350.
Carbon black	5	11	NA.

See footnotes at end of table.

Table 2.—Norway: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Coal and coke, including briquets:			
Anthracite and bituminous coal	164,422	77,042	West Germany 74,242; Australia 1,003.
Coke and semicoke	1,007	105,764	United States 45,177; Romania 33,315; Netherlands 14,500.
Peat, including peat briquets and litter	5	1	NA.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	100,912	124,205	United Kingdom 120,098; West Germany 1,364.
Refinery products:			
Gasoline, including natural do	3,169	3,600	Sweden 1,258; Netherlands 1,039; Denmark 644.
Kerosine and jet fuel do	881	216	Denmark 148; Sweden 67.
Distillate fuel oil do	6,000	6,541	Denmark 2,204; Sweden 1,841; Netherlands 1,406.
Residual fuel oil do	6,090	3,109	Denmark 1,194; Sweden 1,043; Netherlands 517.
Lubricants do	6	5	Sweden 3; Denmark 1.
Mineral jelly and wax do	2	6	Mainly to Sweden.
Other:			
Liquefied petroleum gas do	248	249	United States 73; United Kingdom 73; Sweden 59.
Nonlubricating oils, n.e.s do	9	10	Sweden 7; Finland 1.
Petroleum coke do	454	762	Netherlands 490; U.S.S.R. 201.
Unspecified do	2	([1])	NA.
Total do	16,861	14,498	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	19,894	32,399	Netherlands 22,262; Denmark 5,550.

NA Not available.
[1] Less than 1/2 unit.

Table 3.—Norway: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite	10,542	3,706	Greece 2,285; Sweden 1,379.
Alumina	1,301,464	1,229,492	Surinam 357,965; Jamaica 303,694; Australia 204,344.
Metal including alloys:			
Scrap	519	355	Denmark 283; Sweden 68.
Unwrought	8,501	7,949	Sweden 4,294; United Kingdom 2,118.
Semimanufactures	44,713	39,720	West Germany 17,877; Sweden 8,439; Belgium-Luxembourg 3,384.
Antimony metal including alloys	17	22	China, mainland 20.
Arsenic trioxide, pentoxide, acid	59	--	
Chromium:			
Chromite	28,146	5,372	Albania 5,221; Finland 151.
Oxide and hydroxide	246	258	U.S.S.R. 110; West Germany 70; Italy 40.
Cobalt:			
Oxide and hydroxide	10	9	Belgium-Luxembourg 9.
Metal including alloys, all forms	5	3	West Germany 2.
Copper:			
Oxide and hydroxide	118	562	West Germany 400; Finland 142.
Copper sulfate	1,652	1,451	U.S.S.R. 753; Belgium-Luxembourg 342; Czechoslovakia 260.
Metal including alloys:			
Scrap	1,410	414	Denmark 159; United States 109; Belgium-Luxembourg 91.
Unwrought	1,749	3,920	United Kingdom 1,845; West Germany 852; Sweden 527.
Semimanufactures	27,196	25,623	Sweden 9,215; West Germany 7,254; United Kingdom 3,006.
Gold metal, worked or partly worked troy ounces	63,626	38,388	United Kingdom 19,386; West Germany 12,153.

See footnotes at end of table.

Table 3.—Norway: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Iron and steel:			
Ore and concentrate	119,993	121,106	Sweden 76,029; U.S.S.R. 45,077.
Metal:			
Scrap	18,346	10,064	Denmark 7,634; Sweden 1,564.
Pig iron, ferroalloys, similar materials	14,530	11,891	Finland 3,915; Sweden 2,057; West Germany 1,723.
Steel, primary forms	124,039	122,572	Netherlands 115,105; Sweden 903; United Kingdom 577.
Semimanufactures:			
Bars, rods, angles, shapes, sections	275,281	255,082	Sweden 61,572; West Germany 56,289; United Kingdom 26,343; France 23,514.
Universals, plates, sheets	542,151	504,731	West Germany 76,554; Belgium-Luxembourg 56,122; Sweden 53,888.
Hoop and strip	34,026	27,947	West Germany 7,387; Sweden 5,546; Belgium-Luxembourg 4,089.
Rails and accessories	16,182	23,315	Sweden 19,291; West Germany 2,431.
Wire	15,269	14,701	Belgium-Luxembourg 5,621; Sweden 4,304; United Kingdom 1,511.
Tubes, pipes, fittings	142,262	129,532	West Germany 46,227; France 21,036; Sweden 15,912.
Castings and forgings, rough	2,442	NA	
Total	1,027,618	955,308	
Lead:			
Oxides	923	742	United Kingdom 424; West Germany 249.
Metal including alloys:			
Scrap	5	36	Denmark 26.
Unwrought	12,055	13,178	United Kingdom 6,304; Denmark 3,662; Sweden 2,860.
Semimanufactures	1,231	1,291	Netherlands 629; West Germany 220; Belgium-Luxembourg 213.
Magnesium metal including alloys:			
Unwrought	302	1,099	United States 1,006; U.S.S.R. 50.
Wrought	13	41	Italy 12; United States 12; West Germany 3.
Manganese:			
Ore and concentrate	591,350	808,130	Republic of South Africa 365,589; Brazil 201,004; Gabon 124,751.
Oxides	299	316	Netherlands 200; Belgium-Luxembourg 66.
Metal including alloys, all forms	916	1,205	Republic of South Africa 1,040; United States 146.
Mercury 76-pound flasks	132	29	NA.
Molybdenum metal including alloys, all forms	2	1	All from Austria.
Nickel:			
Matte, speiss, similar materials	71,330	54,429	Canada 48,554; Republic of South Africa 3,280; Australia 2,338.
Metal including alloys:			
Unwrought	220	638	Finland 573; United Kingdom 27; France 15.
Semimanufactures	217	191	West Germany 81; United Kingdom 52; Sweden 20.
Platinum-group metals and silver:			
Waste and sweepings kilograms	18,463	14,949	Sweden 11,161; Denmark 2,640.
Metals including alloys:			
Platinum-group troy ounces	4,790	12,798	United Kingdom 5,851; West Germany 2,154; Switzerland 1,157.
Silver thousand troy ounces	4,433	3,531	United Kingdom 1,840; West Germany 1,266.
Tin, metal including alloys:			
Scrap	2	4	All from Sweden.
Unwrought	622	644	United Kingdom 465; Denmark 98; Netherlands 50.
Semimanufactures	417	234	United Kingdom 122; Denmark 70; West Germany 29.
Titanium:			
Ore and concentrate	86	176	All from Australia.
Oxide	347	519	West Germany 389; United Kingdom 79.
Tungsten metal including alloys, all forms	1	2	NA.
Uranium and thorium:			
Oxides, including rare-earth oxides	126	125	United States 95; West Germany 23.
Zinc:			
Ore and concentrate	57,581	74,386	All from Sweden.
Oxide and pentoxide	2,042	2,218	East Germany 1,894; Sweden 267.
Metal including alloys:			
Scrap	1,604	1,713	Sweden 1,243; Denmark 415.
Blue powder	60	115	United Kingdom 80; Netherlands 35.
Unwrought	2,457	733	United Kingdom 382; Poland 325.
Semimanufactures	949	882	France 394; United Kingdom 148; Netherlands 86.

See footnotes at end of table.

Table 3.—Norway: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Other:			
Ores and concentrates	349	373	Australia 352.
Ash and residue containing nonferrous metal, n.e.s	27,626	36,588	Sweden 32,046; Netherlands 2,540; Denmark 1,723.
Metals including alloys, all forms:			
Metalloids	11	20	West Germany 14.
Alkali, alkaline earth, rare-earth metals	168	302	United States 101; Brazil 84; France 50.
Pyrophoric alloys	2	--	
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum	8,569	14,273	Netherlands 7,499; West Germany 3,408; Portugal 1,958.
Dust and powder of natural or synthetic precious or semiprecious stones, except diamond kilograms	10	15	Netherlands 14.
Grinding and polishing wheels and stones	851	690	Austria 204; Sweden 188; West Germany 145.
Asbestos	2,269	517	West Germany 352; United States 163.
Barite and witherite	61,121	63,204	Netherlands 20,176; West Germany 20,058; Ireland 11,423.
Boron materials:			
Crude natural borates	8,713	7,118	United States 5,610; Turkey 1,400.
Oxide and acid	340	376	France 174; United States 174.
Cement, hydraulic	7,206	6,011	United Kingdom 2,231; Denmark 2,067; Finland 920.
Chalk	9,759	9,519	Denmark 5,194; Sweden 3,247; France 750.
Clays and clay products:			
Crude:			
Fuller's earth, Dinas earth, chamotte	221	910	United States 433; United Kingdom 350; Canada 78.
Kaolin	77,512	79,369	United Kingdom 74,682; Czechoslovakia 3,888.
Other	68,814	1,538	United Kingdom 1,070; Sweden 163; Republic of South Africa 160.
Products:			
Refractory	19,831	15,605	United Kingdom 3,489; Denmark 2,578; West Germany 2,542.
Nonrefractory value, thousands	$8,876	$10,487	West Germany $2,984; Sweden $1,517; Denmark $750.
Cryolite and chiolite	2,180	4,566	Denmark 4,366; West Germany 200.
Diamond, gem, not set or strung thousand carats	95	40	Belgium-Luxembourg 15; United Kingdom 10.
Diatomite and other infusorial earth	2,368	1,960	Denmark 817; Iceland 610; United States 439.
Feldspar	11	--	
Fertilizer materials:			
Crude:			
Phosphatic	367,935	419,329	Israel 109,218; United States 102,490; Togo 92,940.
Potassic	5	40	NA.
Manufactured:			
Nitrogenous	10,372	6,276	Belgium-Luxembourg 5,202; West Germany 490; Czechoslovakia 448.
Phosphatic	11,022	5,917	Sweden 5,506; Netherlands 380.
Potassic	233,398	268,629	France 61,319; Spain 55,948; West Germany 55,208.
Other	5,536	7,427	Sweden 6,131; Netherlands 1,104.
Ammonia	25,139	18,257	Netherlands 12,993; Denmark 5,262.
Fluorspar	42,270	44,972	Morocco 13,850; Spain 9,532; East Germany 6,944.
Graphite, natural	615	654	Sweden 351; United Kingdom 278.
Gypsum and plasters	170,814	144,362	France 61,770; Spain 51,802; Sweden 26,441.
Lime	15,005	10,171	Denmark 8,802; Sweden 1,229.
Magnesite	4,249	2,662	Austria 1,511; China, mainland 610.
Mica, worked and unworked, all forms	129	2,071	India 1,693; Austria 83.
Pigments, mineral:			
Natural, crude	93	--	
Iron oxide, processed	2,506	2,487	West Germany 1,944; Sweden 309; Netherlands 86.

See footnotes at end of table.

Table 3.—Norway: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Precious and semiprecious stones, except diamond, including synthetic stones kilograms	4,408	7,221	Brazil 2,869; Republic of South Africa 2,129; United States 1,153.
Salt and brine	343,767	340,717	Netherlands 160,048; Spain 45,534; Tunisia 37,587.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	31,087	28,325	Belgium-Luxembourg 18,205; Netherlands 8,053.
Caustic potash and sodic and potassic peroxides	1,332	2,964	Belgium-Luxembourg 1,900; Sweden 863.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	313	468	Sweden 331; Italy 93.
Slate	888	1,423	Sweden 1,336.
Other	3,895	4,503	Sweden 2,717; Finland 524; East Germany 401.
Worked, all types	3,097	6,442	Portugal 3,580; Sweden 1,942.
Dolomite	2,979	3,774	United Kingdom 2,624; Sweden 727; West Germany 295.
Flint	602	459	Denmark 334.
Gravel and crushed rock	74,861	68,184	Sweden 64,122; Portugal 2,010.
Limestone	239,080	185,193	United Kingdom 175,100; Denmark 8,168.
Quartz and quartzite	234,918	291,414	Spain 206,386; Sweden 54,449.
Sand, excluding metal bearing	187,261	195,457	Belgium-Luxembourg 112,547; Sweden 57,810.
Sulfur:			
Elemental	11,938	15,533	Denmark 5,194; Poland 3,980; Sweden 3,247.
Sulfur dioxide	4,882	--	
Sulfuric acid	690	274	Denmark 90; Netherlands 87; West Germany 56.
Talc, steatite, soapstone, pyrophyllite	4,597	3,419	India 1,700; Finland 531; Sweden 509.
Other:			
Crude	89,295	78,224	West Germany 75,154; Sweden 2,701.
Slag, dross, and similar waste, not metal bearing	42,628	44,201	Sweden 30,226; United Kingdom 7,557; Belgium-Luxembourg 3,003.
Oxides and hydroxides of magnesium, strontium, barium	709	332	East Germany 122; France 81; United Kingdom 58.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	7,818	8,452	Denmark 2,423; Finland 2,271; Sweden 1,247.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	32	109	United States 80.
Carbon black	4,733	4,113	Sweden 2,797; West Germany 844; United States 145.
Coal, all grades, including briquets thousand tons	421	447	Poland 154; United States 108; United Kingdom 77.
Coke, all types do	481	470	United Kingdom 305; West Germany 62.
Peat, including peat briquets and litter	8,048	11,229	Sweden 9,396; U.S.S.R. 1,654.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	63,705	61,563	United Kingdom 19,529; Iran 10,815; Oman 9,263.
Refinery products:			
Gasoline, including natural do	4,480	4,115	Sweden 1,569; Netherlands 948; Belgium-Luxembourg 522.
Kerosine and jet fuel do	5,234	3,114	Libya 2,041; Belgium-Luxembourg 366.
Distillate fuel oil do	7,282	6,839	Sweden 2,770; Denmark 2,248; Belgium-Luxembourg 1,799.
Residual fuel oil do	2,593	1,193	Libya 223; Belgium-Luxembourg 215; Netherlands 210.
Lubricants do	613	541	United Kingdom 146; Sweden 142; Denmark 114.
Mineral jelly and wax do	90	91	West Germany 51; Hungary 12; United Kingdom 12.
Other:			
Liquefied petroleum gas do	618	3,771	United States 777; Algeria 705; British West Indies 537.
Nonlubricating oils, n.e.s do	--	47	France 20; Belgium-Luxembourg 10; Sweden 6.

See footnotes at end of table.

Table 3.—Norway: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum —Continued			
Refinery products —Continued			
Other —Continued			
Bitumen and other residues thousand 42-gallon barrels	951	908	Netherlands 383; Denmark 215; Belgium-Luxembourg 185.
Bituminous mixtures, n.e.s do	13	16	Denmark 5; United Kingdom 4.
Petroleum coke do	1,507	1,898	United States 1,749; United Kingdom 102.
Total do	23,381	22,533	
Mineral tar and other coal-, petroleum-, or gas derived crude chemicals	23,650	25,251	United Kingdom 10,184; Denmark 8,216.

NA Not available.

COMMODITY REVIEW

METALS

Aluminum.—Norway's primary aluminum industry, the fifth largest among market economy countries, with capacity of about 750,000 tons per year, was under growing public pressure to halt expansion in order to save energy, despite a shortage in world aluminum supply expected in 1981-82. The key to future expansion was the Government's energy program, which was not yet finalized. At present, many expansion projects by the country's six primary producers have been shelved, although several individual projects were advanced during 1978 and 1979.

In 1979, primary metal production increased further to about 95% of capacity. Aardal og Sunndal Verk AS, Norway's biggest aluminum producer, and VEBA AG of the Federal Republic of Germany agreed to form a joint company to produce aluminum and other products in Norway. Investment costs were estimated at $65 million, with Aardal og Sunndal AS holding 60% and VEBA 40%. VEBA is an industrial group, largely owned by the West German Government, involved in electric power generation, coal, and chemicals.

The Aluminium Company of Canada (ALCAN) decided to sell its remaining 25% stake in the Norwegian aluminum producer, Aardal og Sunndal AS, to the company's majority owner, which is the Norwegian Government.

Aardal og Sunndal Verk AS decided to go ahead in expanding its Höyanger aluminum smelter from 28,000 tons to 43,500 tons per year by 1981. A second-stage expansion calls for an increase in smelter capacity to 76,000 tons per year at an unspecified date.

Norsk Hydro AS applied to the Norwegian Government for permission to expand capacity at its 120,000-ton-per-year aluminum smelter at Karmöy near Haugesund by 47,000 tons. The $1.5 million expansion is expected to take about 2 years. In 1977, the company shelved plans to build a new smelter at Glomfjord. The company decided also to reactivate the 46,000-ton-per-year expansion of its Höyanger smelter.

Ownership, location, and capacity of Norwegian primary aluminum plants are shown in table 4.

Table 4.—Norwegian producers of primary aluminum

Company, plant location	Capacity, thousand tons at end of 1979	Ownership
Aardal og Sunndal Verk, Oslo:		Government (75%); Alcan Aluminium Ltd., Canada (25%).
Aardal, Sognefjord	182	
Sunndalsöra, Tingvollfjord	120	
Höyanger, Sognefjord	28	
Mosal Aluminium AS, Oslo:		Elkem Spigerverket AS, Oslo (50%); Aluminum Co. of America (Alcoa) USA (50%).
Mosjöen, Vejnafjord	95	
Lista Island	110	
Norsk Hydro AS, Oslo:		Government (51%); Several private companies (49%).
Karmöy Island	120	
Sör Norge Aluminium AS:		ALUSUISSE (75%); Compadec (25%).
Husnes	72	
DNN Aluminium AS:		Alcoa (50%); The British Aluminium Ltd. UK (50%).
Tyssedal, Sörfjord, Odda	24	

Copper, Lead, Zinc.—The Government had plans to close three more of Norway's 12 remaining copper mines, leaving only nine because it cannot justify the annual outlay of about $20,000 per employee to keep the mines open. The surviving mines will be subsidized from the State copper fund, which is slated to receive an additional $10 million, bringing the total to about $70 million.

Some of the copper ores produced in Norway were processed at Sulitjelma Gruber's 10,000-ton-per-year copper smelter at Sulitjelma, east of Bodö; the remaining copper ores were exported, as were all domestic lead ores.

Norway's 12 complex sulfide ore mines, distributed throughout the country, were operated by 10 independent companies. The ores mined contained mostly copper, lead, zinc, and iron sulfides. Among the more important mines were A/S Sulitjelma Gruber's Fauske Mine, east of Bodö (copper, lead, zinc), Grong Gruber A/S's Röyrvik Mine near the Swedish border (copper, zinc), Folldal Verk A/S's Dovre and Kvalsund mines in southern and northern Norway (copper, zinc, pyrites), and Orkla Industrier A/S's Keldal Mine, south of Trondheim (copper, zinc, pyrite).

Det Norske Zinkkompani (Boliden AB)'s Eitrheim, Odda, 90,000-ton-per-year electrolytic zinc smelter was to be expanded to 105,000 tons per year of zinc by 1980. The plant processed all domestic and also some imported zinc concentrates.

Iron Ore.—In 1978, Norsk Jernverk's Rana Mine started construction of a new concentrating plant for its iron ores. The new plant is scheduled for completion in 1980-81.

Work was completed by the Swedish company, Luossavaara Kirunavaara AB, to expand iron ore loading facilities at Narvik, one of the world's largest iron ore shipping facilities. Capacity has been increased to 30 million tons per year. The latest expansion, completed in 1978, included pellet-screening facilities, a stacker, and a bucket-wheel reclaimer at the port's fifth berth. The port can handle ships to 75,000 deadweight tons. Other important iron ore ports in Norway were Kirkenes near the U.S.S.R. border, for loading up to 125,000-deadweight-ton ore carriers at a rate of 4,000 tons per hour, and the port of Malm on Beistadfjord, for loading of up to 35,000-deadweight-ton ships at a rate of 1,500 tons per hour.

Folldal Verk AS has concluded a long term contract for supplying 20,000 tons per year of magnetite concentrate produced as a byproduct at its Tverrfjellet metal mine located near Kjerkinn, central Norway, to the National Coal Board of the United Kingdom. The concentrate will be used for heavy-media separation of coal.

In 1978 and 1979, iron ore production did not significantly change. Norway's three largest iron ore mines were Government owned: AS Sydvaranger's Sör Varanger Mine near Kirkenes (capacity 2.3 million tons of concentrate per year), Norsk Jernverk's Rana Gruber Mine near Mo (1.2 million tons), and Fosdalens Bergverks AS's Verran Mine (510,000 tons). Privately owned AS Rödsand Gruber was located on the west coast (150,000 tons). Minor quantities of iron ore were produced also as a byproduct of ilmenite and vanadium production.

Iron and Steel.—After the bankruptcy in 1977 of Stavanger Staal AS, Norway's only stainless steel producer, located in Jörpeland, the Government decided in 1978 to establish a new company, Nye Stavanger Staal AS by granting a loan of $1 million and guaranteeing loans up to $4 million.

Norsk Jernverk has completed plans for the construction of a continuous casting plant at its Mo-i-Rana works on the west coast.

Elkem Spigerverket AS was doubling its production capacity for silicon metal to 24,000 tons per year by adding another furnace at its Bremanger smelter, located on Norway's west coast north of Florö. The $20 million plant was scheduled for completion in 1980.

Crude steel production came mainly from Government-owned AS Norsk Jernverk's Mo-i-Rana plant, Elkem Spigerverket's Nydalen plant near Oslo, and Stavanger Staal AS's Jörpeland plant. There were nine other companies in the specialty steel business at various locations.

Magnesium.—Although Norsk Hydro had earlier withdrawn from the actual mining project, it was expected to receive the output of magnesium chloride from a solution mine in the Groningen area in the Netherlands for magnesium metal production in Norway. The Dutch Government had given Billiton Delftstoffen (Holland), a subsidiary of Royal Dutch Shell, permission to exploit a large magnesium salt deposit found in Groningen.

Norsk Hydro AS's 70,000-ton-per-year Porkagrunn plant, near Oslo, was the country's only magnesium smelter.

Molybdenum.—In 1979, rapidly rising molybdenum prices prompted the Norwegian Ministry of Industries to consider reopening the Knaben molybdenum mines near Kristiansand, south Norway. The mines were closed 7 years ago.

Nickel, Cobalt, Platinum-Group Metals.—The Kristiansand refinery of Falkonbridge Nikkelverk AS, a subsidiary of Falconbridge Nickel Co. of Canada, remained the country's only producer of nickel-group metals using nickel matte imported from Canada. Production of nickel in 1978 decreased over 10%.

Titanium.—Titania AS, a subsidiary of NL Industries of New Jersey, continued to be Europe's largest titanium ore (ilmenite) producer. The Tellnes deposit, located near Hauge i Dalane on the south coast, supplied about 17% of world ilmenite production. Some byproduct magnetite concentrate and pyrite were also produced. Kronos Titan AS produced some titanium pigment at Frederickstad, on the south coast. The rest of the ore is exported.

Yttrium.—A/S Megon (Metal Extractor Group of Norway) & Co. operated a 30- to 50-ton-per-year extraction plant at Kjeller, about 12 kilometers east of Oslo, producing 99.999% yttrium oxide. Nine Norwegian companies had an interest in Megon: Elkem Spigerverket, Dyno Industries, Aardal og Sunndal Verk, Norzink, Sulitjelma Gruber, H. Bjorun, S.D. Cappelen, Norwegian Talc, and Sydvaranger. Raw material used is xenotime from the U.S.S.R., Malaysia, and Australia and Japanese rare-earth plant byproducts.

The company had a joint venture with Malaysian interests to operate a concentrator near Kuala Lumpur, producing 27 tons of 60% Y_2O_3 concentrate per year, which was converted at the company's plant in Kjeller to a purity of 99.99999% Y_2O_3, and used mainly for red phosphors in color television screens.

NONMETALS

Cement.—Norcem, Norway's only cement concern, planned to build a cement plant at Verdal at a cost of $390 to $450 million using Government support. In 1978 and 1979, the company controlled three plants totaling 2.3 million tons capacity.

Fertilizer Materials.—Norsk Hydro has signed a deal to buy 100,000 tons per year of apatite concentrate (36% P_2O_5) for 5 years from Luossavaara Kirunavaara AB of Sweden. This represents about one-quarter of the company's yearly requirements. Norsk Hydro accounted for most of the fertilizer materials produced in Norway, including ammonia capacity of 830,000 tons per year.

Norsk Hydro has started to expand its mixed fertilizer capacity by 60,000 tons to 510,000 tons at Glomfjord, west of Mo. Supplies of domestic ammonia and imported phosphate rock are expected to be available for this purpose.

Sulfur.—Seven companies operating one mine each accounted for the sulfur contained in about 300,000 tons of pyrite concentrates produced annually in Norway in 1978 and 1979.

Other Nonmetals.—A number of industrial minerals were produced in Norway in 1978 and 1979. Norwegian Talc AS prepared about 60,000 tons per year of white dolomite filler from its Hammerfall Mine in north Norway, processed at Knarrevik near Bergen. White marble was produced in the Nordmore region, northeast of Aalesund by Hustad Kalk og Marmor AS at Elnesvaagan (100,000 tons per year), Langnes Marmorbrudd at Eide (20,000 tons per year), and Visnes Kalk og Marmorbrudd AS at Lyngstad (100,000 tons per year).

Ground limestone filler was produced by Franzefoss Bruk, Hylla Kalkverk, and Aardal og Sunndal Verk AS.

Synthetic abrasive grain was produced by Arendal Smelterverk AS, a subsidiary of Carborundum Co., United States, at Arendal (37,000 tons per year), Norton AS at Lillesand (12,000 tons per year), and Orkla Exolon AS & Co. at Orkanger (12,000 tons per year).

MINERAL FUELS

Over four-fifths of Norway's energy supply (production plus imports) was domestic oil and gas, and less than one-fifth was domestic hydroelectric power. Domestic coal was insignificant. All natural gas and more than half of the crude oil produced was exported.

Norway's supply and apparent consumption of fuels and power in 1977 and 1978 are shown in table 5.

Table 5.—Norway: Supply and apparent consumption of fuels and power for 1977 and 1978

(Million tons of standard coal equivalent)[1]

	Total energy	Coal and coke	Crude oil and petroleum products	Natural gas	Hydro-electric power[3]
1977:[2]					
Production	34.1	0.5	20.3	3.6	9.7
Imports	18.5	.9	17.3	--	.3
Exports	27.3	.2	23.3	3.6	.2
Apparent consumption	25.3	1.2	14.3	--	9.8
1978:[2]					
Production	54.4	.4	36.0	8.0	10.0
Imports	15.8	.9	14.8	--	.1
Exports	36.9	.2	27.6	8.0	1.1
Apparent consumption	33.3	1.1	23.2	--	9.0

[1] Coal equivalent of 7,000 kilocalories per kilogram.
[2] Secondary included in trade.
[3] Primary energy only.

Source: Monthly Bulletin of Statistics. Central Bureau of Statistics, Oslo, Norway, No. 12, 1978; Monthly Bulletin of External Trade, Oslo, December 1979, Norway 1979; Central Bureau of Statistics.

Coal.—The Government-controlled Store Norske Spitsbergen Kullkompani AS continued coal production on Svalbard Island at a decreased rate of 378,000 tons per year in 1978 and 1979. The U.S.S.R. continued coal mining nearby at an estimated rate of 400,000 tons per year.

Petroleum and Natural Gas.—In 1978, oil and gas production rose to approximately 30 million tons of oil equivalent including exports of 13.5 billion cubic meters of natural gas. Exports of oil and gas for the same period netted $2.9 billion. In 1979, oil and gas production was expected to reach almost 40 million tons of oil equivalent, valued at about $4 billion at 1978 prices. The action of the OPEC countries in raising the price of crude oil contributed to Norway's increased oil income.

July 1978 marked the beginning of the production of crude oil from the Thor oilfield, located in block 2/4 and tied in to Ekofisk center. Thor is, after Cod, the fifth oilfield in the Norwegian sector of the North Sea to go into production; the rate of production was to be 3.5 million tons of crude oil and 720 million cubic meters of natural gas per year.

In 1978, there were two significant oil discoveries in the North Sea in the "Golden Block" at block 34/10 of the Statfjord field. There were also gas and condensate discoveries, one located west of the Sleipner field in block 15/5, and one in block 1/9-3 that was drilled with the "Ross Rig."

In 1979, Norske Shell AS made a significant gas find in block 31/2 that could be several times the size of the Frigg field, but production is not expected until the 1990's because of the depth of the water there. Gas was also found in Statoil's block 30/6. Statoil's well in 34/10 was tested at 650 tons per day from Middle Jurassic sandstone.

At the end of 1979, offshore construction work on Statfjord platform "A" had been completed, and development drilling had started. Twenty-inch casing was set in the first four wells. Statfjord development costs increased from $2.9 billion to $6.3 billion, caused partly by recent safety regulations. Production was due to start by the end of 1979.

The Petroleum Directorate was considering relaxing royalties and tax rates for North Sea oil discoveries considered marginal such as Heimdal, Sleipner, West Frigg/Northeast Frigg, Odin, and British Petroleum-Statoil and Phillips-Statoil strikes in blocks 7/12 and 1/9 in an attempt to bring them onstream as quickly as possible.

Norway was to retain full control of its oil resources while retaining membership of the International Energy Agency (IEA).

It was expected that the Government would approve test drilling north of the 62d parallel on Halten Bank, north of Trondheim, and Fugloy Bank, north of Tromsø, during spring in 1980, shortly before the beginning of the drilling season. The first exploration licenses for the area awarded in December 1979 went to three Norwegian companies, SAGA Petroleum, Statoil, and Norsk Hydro.

Location of a $4 billion petroleum refinery employing 2,100 workers, north of the 62d parallel, was the object of a study by authorities. It was found that dispersing such a facility into eight separate units would significantly increase construction and operating costs.

According to a Norwegian Government policy statement, Statoil, the Government-owned oil company, will have at least 50% of all future block allocations on the continental shelf, but Norsk Hydro AS and SAGA Petroleum AS will also be included to some extent.

The $60 million feasibility study for the pipeline project from the Statfjord oilfield to Sotra Island on the Norwegian coast was successfully completed, and cost estimates for the project were submitted.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values in Norwegian kroner (NKr) have been converted to U.S. dollars at the rate of NKr5.10=US$1.00 for 1979.

The Mineral Industry of Pakistan

By David E. Morse[1]

Mineral production in Pakistan during 1978 and 1979 remained modest by world standards. Although Pakistan produced a variety of industrial minerals, fuels, and a few metallic ores, output was of domestic significance only. Exploration for minerals and fuels was conducted by several federal and provincial agencies; faced with limited resources and an escalating bill for imported crude oil and petroleum products, federal funding for petroleum exploration was more than four times the exploration budget for nonfuel minerals in 1978-79.

The success of the federally owned Oil and Gas Development Corp. (OGDC) in finding oil outside of the Potwar Basin in 1976, the relatively high price of crude oil on the world market, and amendments to Pakistan's tax laws specifically written to encourage foreign companies to explore for petroleum in Pakistan resulted in nine new exploration agreements between the Government and foreign oil companies in the 1977-79 period. The country's need for a significant increase in domestic output of crude oil was clearly demonstrated in 1979 when world crude oil prices escalated over 80%, which placed a severe burden on Pakistan's foreign exchange reserves.

Two federally owned, mineral development agencies, Resources Development Corp. (RDC) and Pakistan Mineral Development Corp. (PMDC), continued to operate through 1979. RDC was concerned exclusively with the development of the Saindak copper deposits, and PMDC covered all mineral fields except Saindak copper, nuclear materials, and oil and gas. In addition, Pakistan's Geological Survey conducted geologic studies and nonpetroleum mineral exploration. Three provincial governmental bodies, the Baluchistan Development Authority (BDA), the Punjab Mineral Development Corp. (Punjmin), and the Sarhad Development Board (of the Northwest Frontier Province) performed nonpetroleum exploration and development functions within their regions, often in conjunction with PMDC or through contractors. The Agency for the Federal Administered Tribal Areas held mineral responsibility for the tribal areas of Baluchistan and Northwest Frontier provinces. The Government established a gem stones corporation in 1978, which was responsible for the mining, cutting, polishing, marketing, and exclusive exporting of stones (for example, Swat emeralds and Hunza rubies).

Domestic private industry's role in the mining sector continued to be limited both by government policy and by investor caution. Government policy had been to maintain control of those industries considered essential to the economy except where foreign technology and/or capital were required. After the Martial Law Administration took over control of the Government in 1977, a new stance was taken toward industry, and some previously nationalized processing plants had been returned to private industry in 1978 and 1979. Nonetheless no sweeping changes had been announced, and private investors continued to be suspicious about new ventures, which resulted in little or no capital input from the non-Government sector in areas other than light industry and commerce.

Pakistan's domestic economy registered generally good years in both fiscal 1977-78 and fiscal 1978-79[2]. Pakistan's gross domestic product (GDP) was $17.9 billion[3] in fiscal 1978-79, a growth of 5.9% in constant 1959-60 prices. The growth of the GDP in fiscal 1977-78 was nearly 7% in constant 1959-60 prices. The growth of Pakistan's gross national product (GNP) surpassed the growth in the GDP because of the increased and substantial contribution of Pakistanis working overseas. The GNP increased 10% in fiscal 1977-78 and by 6.3% in fiscal 1978-79. Pakistan's GNP was $17,039 million in fiscal 1977-78 and $19,352 million in fiscal 1978-79.

Notwithstanding growth in the domestic economy and the over $1 billion in home remitances, Pakistan's economy was under substantial strain because of the nation's poor position in its external finances. Record trade deficits in 1977-78 and 1978-79, plus increasing debt service payments caused a significant decline in foreign exchange reserves during 1979. To decrease the federal budget deficit, which would include additional external financing, a package of new and increased taxes was instituted to raise over $500 million in additional revenue in fiscal 1979-80.

PRODUCTION

Mining and quarrying contributed 0.78% to the nation's GDP in fiscal 1977-78 and 0.82% in fiscal 1978-79. Domestic natural gas, Pakistan's most abundant fuel, was used to supply nearly 35% of the nation's commercial energy in 1978 and 1979. Crude oil output from fields in the Potwar Basin of northeast Pakistan supplied only 10% to 12% of the nation's petroleum requirements. By late 1979, crude oil production had reached 11,500 barrels per day at the Rawalpindi refinery, the only refinery in the producing area. A $31.6 million expansion program at the Rawalpindi plant got underway in 1979 to accomodate increased output from the Meyal and other nearby oilfields.

Processing mineral commodities was of importance to the economy especially by reducing the need for imported, expensive, finished goods. Pakistan's domestic cement industry had a capacity of 3.45 million tons per year in 1979. Nitrogenous fertilizers were produced utilizing domestic natural gas as feedstock, and complex fertilizers were produced from domestic and imported materials. The nation produced finished steel products from domestic and imported scrap and from imported steel. Other metals were imported and processed by the country's foundaries and forges. Two petroleum refineries near Karachi processed imported crude oil for domestic consumption.

Table 1.—Pakistan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^{p}	1979^{e}
METALS				
Aluminum: Bauxite, gross weight	124	151	1,621	[illegible]
Antimony ore:				
Gross weight	55	94	104	[illegible]
Metal content*	11	19	31	[illegible]
Chromium: Chromite, gross weight	10,872	8,400	11,000	[illegible]
Iron and steel: Mild steel products thousand tons	243	277	349	[illegible]
Manganese ore, gross weight	64	58	286	[illegible]
NONMETALS				
Abrasives, natural: Emery	907	657	887	[illegible]
Barite	9,380	17,718	19,194	[illegible]
Cement, hydraulic thousand tons	3,138	3,165	3,108	[illegible]
Chalk	1,976	1,105	1,091	[illegible]
Clays:				
Bentonite	747	1,069	906	[illegible]
Fire clay	29,019	53,100	50,000	[illegible]
Fuller's earth	16,000	18,000	18,000	[illegible]
Kaolin (china clay)	346	506	13,758	[illegible]
Other	60,000	65,000	76,000	[illegible]
Feldspar	2,705	3,690	14,306	[illegible]
Fluorspar	10	---	335	[illegible]
Gypsum, crude	447,000	283,000	258,000	[illegible]
Magnesite, crude	3,246	1,567	2,672	[illegible]
Nitrogen: N content of ammonia	326,700	315,300	309,200	[illegible]

See footnotes at end of table.

Table 1.—Pakistan: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^p	1979^e
NONMETALS —Continued				
Pigments, mineral, natural: Ocher	15,795	14,310	4,672	1,000
Salt:				
Rock thousand tons	375	385	413	[1]487
Marine do.	144	114	227	[1]192
Total do.	519	499	640	[1]679
Sand and gravel:				
Gravel	46,000	40,000	96,000	60,000
Sand:				
Bajri and common	29,549	14,131	20,836	25,000
Glass	44,668	66,088	69,656	65,000
Sodium and potassium compounds:				
Caustic soda	30,660	25,914	34,605	35,000
Soda ash, manufactured	63,288	60,579	74,019	70,760
Stone:				
Aragonite and marble	29,000	34,000	39,000	34,000
Dolomite	1,162	2,723	11,426	9,000
Limestone thousand tons	3,000	3,895	2,887	3,500
Crushed do.	1,740	693	172	1,000
Strontium minerals: Celestite	603	365	217	200
Sulfur:				
Native	1,326	1,160	1,083	1,100
Byproduct, all sources^e	12,000	12,000	14,000	14,000
Total	13,326	13,160	15,083	15,100
Talc and related materials: Soapstone	5,035	9,179	25,290	27,200
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades thousand tons	1,349	1,154	1,036	1,050
Gas, natural, sales million cubic feet	183,635	180,324	195,784	221,000
Natural gas liquids^e thousand 42-gallon barrels	32	32	36	38
Petroleum:				
Crude do.	2,562	3,720	3,491	3,875
Refinery products:				
Gasoline do.	2,152	4,015	3,735	3,900
Jet fuel do.	3,176	3,221	3,893	4,200
Kerosine do.	2,005	1,840	1,749	2,400
Distillate fuel oil do.	5,822	5,120	7,619	7,800
Residual fuel oil do.	9,032	6,057	7,734	7,000
Lubricants do.	501	609	616	610
Other do.	1,420	926	9,392	8,500
Refinery fuel and losses do.	834	2,057	2,000	2,100
Total do.	24,942	23,845	36,738	36,510

^e Estimate. ^p Preliminary.
[1] Reported figure.

TRADE

Pakistan's material trade balance continued to be highly unfavorable despite record performances in exports in both fiscal 1977-78 and 1978-79. Exports increased 14.9% in fiscal 1977-78 and 29.5% in fiscal 1978-79, primarily on the strength of the agriculture sector. Imports for the same period increased by 20.4% and 31.3%, respectively, and the trade deficit for fiscal 1978-79 rose to $1,977 million.

Pakistan's trade in mineral commodities was an important part of the deficit. Exports of barite, chromite, and petroleum products were the only significant mineral exports. Imports of petroleum and petroleum products, fertilizer materials, iron and steel products, nonferrous metals, and cement were valued at nearly $1.17 billion in fiscal 1978-79 or 32% of the value of total imports. Mineral exports were only valued at 5.5% of mineral imports in fiscal 1978-79. Pakistan planned to decrease its mineral trade deficit by increasing domestic crude oil production, by building more fertilizer plants, increasing cement capacity, and by completing a major steelmaking facility.

The following tabulation lists the value of Pakistan's mineral imports, by major group.

Table 2.—Pakistan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1974-75	1975-76
METALS		
Aluminum:		
Oxide and hydroxide	273	200
Metal including alloys:		
Scrap	1,740	7,154
Unwrought and semimanufactures	12,900	2,161
Arsenic trioxide, pentoxide, acid	5	42
Chromium oxide and hydroxide	3	3
Cobalt oxide and hydroxide	1	2
Copper:		
Ore and concentrate	45	64
Metal including alloys:		
Scrap	2,250	[illegible]
Unwrought and semimanufactures	7,161	[illegible]
Iron and steel:		
Ore and concentrate, including roasted pyrite	32	[illegible]
Metal:		
Scrap	134,024	[illegible]
Pig iron, sponge iron, powder, shot	119,581	[illegible]
Ferroalloys	7,712	[illegible]
Steel, primary forms	138,391	[illegible]
Semimanufactures	283,193	[illegible]
Lead:		
Ore and concentrate	78	[illegible]
Oxide	487	[illegible]
Metal including alloys, all forms	2,267	[illegible]
Manganese:		
Ore and concentrate	194	--
Oxide	836	[illegible]
Mercury ... 76-pound flasks	71,123	1,135
Nickel metal including alloys, all forms	139	106
Platinum-group and silver metals including alloys ... troy ounces	1,768	645
Tin metal including alloys, all forms	274	137
Titanium oxide	693	772
Zinc:		
Oxide	427	[illegible]
Metal including alloys:		
Scrap and blue powder	211	1,515
Unwrought and semimanufactures	4,917	[illegible]
Other:		
Ores and concentrates	60	--
Ash and residue containing nonferrous metals	165	[illegible]
Oxides, hydroxides, peroxides of metals	27	115
Metals including alloys, all forms:		
Metalloids	15	1
Alkali, alkaline earth, rare-earth metals	35	[illegible]
Base metals including alloys, all forms, n.e.s	123	[illegible]
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	561	[illegible]
Grinding and polishing wheels and stones	198	[illegible]
Asbestos, crude	4,874	[illegible]
Barite and witherite	1,185	[illegible]
Cement	107	[illegible]
Chalk	2,167	[illegible]
Clays and clay products:		
Crude:		
Bentonite	85	[illegible]
Fuller's earth	1,656	[illegible]
Kaolin	1,876	[illegible]
Other	1,347	[illegible]
Products:		
Refractory	5,985	[illegible]
Nonrefractory	521	[illegible]
Diatomite	66	[illegible]
Feldspar and fluorspar	22	[illegible]
Fertilizer materials:		
Crude:		
Nitrogenous	3,484	[illegible]
Phosphatic	23,782	[illegible]
Manufactured:		
Nitrogenous	300,707	[illegible]
Phosphatic	11,177	[illegible]
Potassic	1	[illegible]
Mixed	20,073	[illegible]
Ammonia	11	[illegible]

See footnotes at end of table.

Table 2.—Pakistan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity		1974-75	1975-76
NONMETALS —Continued			
Graphite, natural		112	552
Magnesite		598	829
Pigments, mineral, including processed iron oxides		296	883
Precious and semiprecious stones, excluding diamond	kilograms	3,017	1,460
Sodium and potassium compounds:			
Caustic soda		2,734	34,013
Caustic potash		254	31
Sodium and potassium peroxides		4	105
Stone, sand and gravel:			
Dimension stone, crude and partly worked		83	21
Gravel and crushed rock		--	7
Quartz and quartzite		55	--
Sand, excluding metal bearing		1	21
Sulfur:			
Elemental, all forms		20,752	7,077
Sulfuric acid		37	16
Talc, steatite, soapstone, pyrophyllite		186	20
Other:			
Crude		901	2,025
Bromine, iodine, fluorine		3	1
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		27	133
Carbon black		1,962	1,292
Coal and coke, including briquets		77,661	39,625
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	18,827	20,710
Refinery products:			
Gasoline	do	300	406
Jet fuel	do	13	2
Kerosine	do	2,974	2,350
Distillate fuel oil	do	5,519	5,899
Residual fuel oil	do	62	28
Lubricants	do	57	22
Other:			
Paraffin, petroleum jelly, wax	do	27	75
Unspecified	do	53	1,198
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		3,533	844

COMMODITY REVIEW

METALS

Bauxite.—Punjmin was investigating bauxite deposits near Khushab in the Sargodha district, Punjab, and in 1978 reported 340,000 tons of ore averaging 63% alumina and an additional 11.4 million tons at 40% alumina. Punjmin received a $1.68 million loan from the United States in 1979 to aid in determining the suitability of the Khushab ore for alumina production and for use as refractory-grade bauxite.

Chromite.—The bulk of Pakistan's chromite production came from the Zhob Valley region of Baluchistan near Muslimbagh. BDA was building a 20-ton-per-day pilot plant to test the low-grade chromite ores of the Zhob region. Government plans for chromite development near Muslimbagh included an 18,000-ton-per-year concentrator, a 15,000-ton-per-year ferrochrome plant, and a refractory brick plant.

Copper.—In 1979, PDC awarded a contract to Mountain States Mineral Enterprises Inc. of the United States to conduct a preliminary engineering and feasibility study for an integrated 12,500-ton-per-year copper project at Saindak, Baluchistan. In 1977, Seltrust Engineering Ltd. of the United Kingdom completed a preliminary feasibility study on the Saindak deposits that recommended a mine and mill project that would treat 12,500 tons per day of ore to produce 165 tons per day of copper concentrate, 250 tons per day of magnetite concentrate, and 205 tons per day of pyrite concentrate. The concentrates were to be shipped to processing facilities near Karachi for the production of blister copper, sulfuric acid, and steel billets. Additionally, small amounts of molybdenum, silver and gold were to be recovered from the concentrates at the processing facilities.

Iron Ore.—Geologic investigations reportedly discovered good quality iron ore deposits in Pakistan; 10 million tons was delineated in Dar Ghazi Khan district Punjab, 5 million tons in Chagai district Baluchistan, and 32 million tons in the Kohistan district, Northwest Frontier Province. The Kohistan deposits were discovered while prospecting for barite, and laboratory analysis of samples resulted in assays of 54% to 65% iron. Preliminary estimates of the Kohistan deposits were as high as 100 million tons, although the deposits have not been officially investigated.

Iron and Steel.—Pakistan Steel Mills Corp. continued erecting the new Pipri steelworks near Karachi. The mill's first blast furnace was to be "blown-in" in 1980 and full operation of the steel making plant was scheduled for 1981. The completed works was to have an annual capacity of 1.1 million tons of raw steel, employ 15,000 workers, and reduce the import of steel products. Port Qasim, which will handle the bulk raw material imports required by the steel mill, neared completion in 1979. Imported iron ore and coal will be unloaded from ore carriers at the port and transported directly to the steel mill by two 4.5-kilometer-long conveyor-belt systems.

In 1978, a heavy forge and foundary was completed with aid from China at Taxila, Punjab, south of Islamabad. The project was designed to produce 28,000 tons of steel ingots, 6,300 tons of steel castings, 4,700 tons of iron castings, and over 7,000 tons of other ferrous manufactures per year. The $45 million project provided employment for about 3,000 and was to save nearly $18 million in foreign exchange annually.

Molybdenum.—Reportedly, large reserves of molybdenum were discovered at Darbanchah, in the Chagi district of Baluchistan. An initial survey has been completed and a drilling program to assess the quality and extent of the mineralization was begun in 1979.

NONMETALS

Barite.—Operations at Bolan Mining Enterprise's (BME) Khuzdar, a 30,000-ton-per-year barite-grinding plant, were suspended on September 24, 1978, following a total interruption of electrical power. To avoid complete loss of production, BME made arrangements for 500 tons per month of barite to be ground by Crown Mills Ltd. of Karachi. BME, a joint enterprise between the government of Baluchistan (50%) and Pakistan Petroleum Ltd. (50%), decided to build its own source of power generation at the grinding plant. Two 250 kilovolt-ampre diesel generators were in operation early in 1979.

Cement.—Cement was in short supply in many areas of Pakistan in 1978 and 1979. Cement imports were valued at $6 million in fiscal 1977-78 and over $20 million in fiscal 1978-79. Pakistan's cement capacity in its nine operating plants was 3.45 million tons per year, and demand was projected to increase from 3.9 million tons in 1978 to 5.1 million tons in 1980. Two 300,000-ton-per-year extensions to existing cement plants were scheduled for completion in 1979: one at Javedan near Karachi was onstream in early 1979; the second near Rawalpindi was to come onstream later in the year. The State Cement Corp. of Pakistan Ltd., the managing agent for all cement companies in Pakistan, planned to increase the country's cement output by building five new cement plants and adding capacity to two established facilities. Additionally, after the Government announced that cement production was no longer closed to private enterprise, numerous proposals were received from private groups requesting approval for the establishment of cement plants in all four provinces of Pakistan.

Fertilizer Materials.—Pakistan continued to import significant quantities of manufactured fertilizers. The value of imported fertilizer materials in fiscal 1977-78 increased to $112 million and shot up to over $270 million in fiscal 1978-79. Pakistan manufactured nitrogenous fertilizer utilizing domestic natural gas and phosphoric fertilizers by processing imported materials. The country did not produce potassic fertilizers from either domestic or foreign sources but imported complex fertilizers to supply the potasium component of fertilizer consumption.

Nitrogenous.—Pakistan produced over 300,000 nutrient tons of nitrogen (N) in a variety of forms in 1978 and 1979. Domestic demand was over 600,000 nutrient tons N for the same period. Pakarab Fertilizers Ltd., a joint venture between the National Fertilizer Corp. of Pakistan (NFC) and Abu Dhabi National Oil Co., completed a $127 million expansion to NFC's Multan fertilizer plant in 1978. The expansion increased ammonia capacity by 300,000 tons per year, ammonium nitrate capacity by 350,000 tons per year, urea capacity by 12,500 tons per year and added facilities for the production of complex fertilizers. Natural gas from the Sui field was used for feedstock for the ammonia plant. NFC, with financing provided by Saudi Arabia and the Asian Development Bank, was building a 1,000-ton-per-day ammonia, 1,750-ton-per-day urea facility at Mirpur Mathelo near Sukpur, Sind, Commissioning was scheduled for 1979, and natural gas from the Mari field was to be used as feedstock.

The Fauji Foundation was setting an ammonia-urea complex at Machi Goth near Sadiqabad, Punjab, in 1979. The $270 million project, based on natural gas from the Mari field, was to have the capacity to produce 250,000 nutrient tons of N per year.

The Pakistan Ajman Fertilizer Corp. proposed to set up a $300 million fertilizer complex on the coast near Port Qasim, Baluchistan. The facility was to use natural gas from the Sui field and imported phosphoric acid for the production of urea and di-ammonium phosphate. The project was slated for completion in 1981.

NFC planned to build a fertilizer complex at Haripur, Northwest Frontier Province, to produce 95,000 tons per year of urea based on Sui gas feedstock in one phase. A second phase was to add facilities for phosphoric acid and mono-ammonium phosphate production utilizing domestic phosphate rock from Kakul. No completion date for this project was announced by yearend 1979.

Phosphatic.—In 1978, the United Kingdom Ministry for Overseas Development approved a $3.14 million grant for PD-NCB Consultants Ltd. to conduct further exploration of the Hazara region phosphate deposits. PD-NCB completed investigations in 1977 of the Kakul deposits and began development of a 57,000-ton-per-year pilot program to supply phosphate rock to NFC's superphosphate plant at Jaranwalla. The new, 2.5-year study, was to center on Dalola and Lagarban and determine the feasibility of establishing a large-scale phosphate rock mine in the area to feed the planned fertilizer complex at Haripur.

Fluorite.—Commercial production of fluorite by the Baluchistan Development Authority commenced at Koh-e-Dilband in the Kalat District of Baluchistan late in 1978.

Salt.—PMDC started exploitation of a new salt mine at Jatuna near Khewa, Punjab, in 1978. This brought salt production capacity from the Salt Range to over 420,000 tons per year. Rock salt was also mined in the Preshawar Division, NWFP. Twenty coastal operations produced solar evaporated marine salt in 1978 and 1979.

MINERAL FUELS

Coal.—Coal was produced in all four provinces of Pakistan with the Salt Range and Makarwal coals from Sind and the Sor Range, Mach Kost, and Sharigh collieries near Quetta, Baluchistan, the major contributors to the nation's output. PMDC planned to develop the Lakra coalfield near Hyderabad to supply 1 million tons of coal per year for a planned 250-megawatt power station at Jameshoro, Sind. Sharigh coal was to be used to augment imported coking coal at the Pipri steel mill.

Natural Gas.—Over 80% of Pakistan's natural gas output came from Pakistan Petroleum Ltd.'s (PPL) Sui gasfield in east central Baluchistan. The Mari gasfield produced over 40 million cubic feet per day exclusively for the Dhakari fertilizer plant. Natural gas was also produced and recovered from oilfields in the Potwar Basin.

Petroleum.—Domestic crude oil production increased from less than 10,000 barrels per day in mid-1978 to over 11,000 barrels per day by yearend 1979, but only supplied 10% to 12% of the nation's requirements. Pakistan Oilfields Ltd.'s (POL) Meyal and Balkassar oilfields and OGDC's Toot oilfield were the major contributors to the country's output in 1978 and 1979. OGDC was committed to increasing Toot ouput to 9,500 barrels per day and completing a 10 well development program at the Dhodak field to produce 22,500 barrels per day by 1981. POL planned to increase Meyal's output to 17,000 barrels per day by 1983.

The PPL-Amoco Pakistan Exploration Co. joint venture discovered oil in 1978 in PPL's East Potwar concession area. Extensive testing on the discovery well, Adhi 5, was conducted in 1978, and Adhi 6 was spudded about 6 miles from Adhi 5 in 1979 to delineate the extent of the field. OGDL discovered oil at Dhermund 1 in 1979 and was conducting test operations at yearend 1979.

Three petroleum refineries were in operation in Pakistan in 1978 and 1979, and a fourth was under construction. Two Government-owned oil refineries near Karachi processed imported crude oil. Attock Oil Co. Ltd. (AOC) processed domestic crude at its Rawalpindi facility near Islamabad. AOC planned to increase the Rawalpindi capacity by 20,000 barrels per day to accommodate the increasing output from the Toot and Meyal oilfields and the anticipated production from the Adhi discovery. Crude oil was to be shipped by pipeline to Multan where a new 40,000-barrel-per-day oil refinery was being built.

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[1] Physical scientist, Branch of Foreign Data.

[2] Pakistans fiscal year is from July 1 to June 30.

[3] Where necessary, values have been converted from Pakistani rupees (PRs) to U.S. dollars at a rate of PRs 9.9=US$1.00.

The Mineral Industry of Peru

By L. Nahai[1]

The Peruvian economy after 2 years of declining aggregate output in 1977 and 1978, recovered in 1979 and was forecast to grow about 1.6%. The reversal in the decline of the gross domestic product (GDP) and the improved international reserve position resulted from the 1978 stabilization program. However, the high inflation rate persisted, about 74% in 1978 and 67% in 1979.

The mineral sector showed a 13% increase in the first half of 1979, primarily because of increased petroleum production; the manufacturing sectors showed evidence of a mild recovery in the same period. The mineral industry accounted for 9.4% of GDP in 1978 and 10% in 1979; mineral exports accounted for about 50% of total exports in 1978 and 45% in 1979.

Government Policies.—There has been a gradual shift in Government policy regarding the development of Peru's many known and explored deposits. The Government is more willing to have foreign capital participate in mineral development. The magnitude of the required capital is such that Peru's own resources cannot meet the need. As a result, many of the mineral projects include some degree of foreign participation. (See Development Plans.) The more favorable attitude to foreign capital participation is illustrated by legislation passed to encourage mining of placer gold. Also, modifications were made in the mining law to provide incentives for the industry.

In 1976, the Government established a 15% export tax that was later increased to 17.5%. In September 1977, copper producers were exempted from the tax owing to low prices, and in May 1978, zinc producers were also exempted until April 1979. In December 1979, zinc producers were exempted from the tax until April 1980. However, the tax was reintroduced for medium-size copper and zinc producers.

Decree-laws were issued in December 1979 authorizing Petróleos del Perú (Petroperú) to renegotiate its existing production contracts with Occidental Oil Co. and Belco Petroleum Corp. The Government also published guidelines to govern existing and future oil contracts (See Petroleum). The Government signed a scientific agreement with the Federal Republic of Germany under which geologists will evaluate the petroleum prospects of the Marañón River basin.

As of January 1, 1979, the Instituto de Geología y Minería (INGEOMIN) and the Instituto Científico Tecnológico Minero (INCITEMI) were merged into Instituto Geologíco Minero Metalúrgico (INGEMMET).

Development Plans.—Both Empresa Minera del Perú (Minero Peru) and Empresa Mineral del Centro del Perú (Centromín) have a number of plans for expanding production in existing mines and plants and developing large known deposits. As is shown by the tabulation that follows, implementation of these plans require substantial capital not available to the two State-owned companies. As a result some of the projects, such as the expansion of the Ilo copper refinery and La Oroya zinc refinery have had to be postponed. However, since the Government is now more willing to be associated with foreign capital, it is expected that some of the plans will be realized in the next few years. For example, private capital will play a role in the development of the Tambo Grande polymetallic deposit and La Granja copper-molybdenum deposit as well as the Bayóvar phosphate mine and fertilizer complex.

Project	Principal development plans and description	Current status	Estimated investment (millions)
CENTROMIN			
Cobriza Mine	Expansion of mine production from 2,600 tons of ore to about 10,000 tons of ore per day and a new 10,000 -ton-per-day refinery to produce 200,000-ton-per-year concentrates with 25% copper.	Postponed in 1978, but work resumed in 1979 and to be completed in 1982.	$181.3
Refinery at La Oroya, 184 kilometers east of Lima.	Expansion from 70,000 to 90,000 tons-per-year for zinc and 58,000 to 73,000 tons for copper; new lead sinter plant.	Plant expansion in abeyance, but work on modernization of the zinc refinery was carried out. The sinter plant project expected to start in 1980.	78
Mine water treatment at Cerro de Pasco.	To replace cement copper precipitation with a solvent extraction/electrowinning plant.	Basic engineering test work completed; on site work started and expected to be completed in 1980.	16
Toromocho, 140 kilometers east of Lima.	To develop a mine to produce 35,000 tons of ore per day.	Feasibility study.	
Cerro Pasco Mine	Expansion of mine production from 6,300 to 8,000 tons per day.	To be executed in the 1979-83 period.	
MINERO PERU			
Cerro Verde - Stage II Phase I mine, located 24 kilometers SW of Arequipa.	Expansion of mine and concentrator to produce 200,000 tons of concentrate annually (60,000 tons of copper).	Proposals have been made by Italian, Japanese and West German companies.	[illegible]
Ilo copper refinery, 5 kilometers from Ilo port.	Expansion from 150,000 to 225,000 tons per year of cathodes.	Postponed to 1981.	
Antamina copper-zinc located in northern Peru in Province of Huari, Department of Ancash.	Development of mine to produce 50,200 tons of copper, 27,000 tons zinc, 487 tons of molybdenum, and 21 tons silver.	Work being done in association with Geomim of Romania which has submitted feasibility study.	[illegible]
Zinc refinery at Cajamarquilla, 25 kilometers east of Lima.	Construction of refinery to treat 200,000 tons of concentrate and produce 100,000 tons of zinc. Byproduct will include 355 tons per year of cadmium	Construction by "Sybetra" of Belgium progressing and expected to be completed in 1980.	[illegible]
San Antonio de Poto gold placer in Department of Puno.	Exploitation of gold placer (345-square-kilometer area).	Minero Perú will exploit the deposit.	[illegible]
Tambo Grande Pyrite	Exploration, development and mining.	Negotiation with BRGM of France; action not initiated.	
Iron pelletizing plant	Expansion.	Postponed.	
Quellaveco, located between Toquepala and Cuajone.	Develop deposit to produce 20,000 or 40,000 tons per day of ore.	Southern Peru Copper Corp. has reportedly shown interest in developing deposit.	300 (for 20,000 ton-per-day alternati
Tintaya in southern Peru, in Province of Espinar, Department of Cusco.	To develop the deposit of sulfide and oxide ore to produce 200,000 tons of copper concentrate for export.	Although many private companies indicated interest, the deposit will be developed by the State-owned, Minero Perú, Centromin, and Cofide.	[illegible]
Michiquillay in Department of Cajamarca.	To develop deposit to produce 394,000 tons of copper concentrate.	Feasibility study stage.	[illegible]
Bayóvar phosphate deposits and potassic brines in Sechura desert in Department of Piura in northern Peru.	To develop deposit to produce 800,000 tons of phosphate rock, phosphate fertilizers, and potassium chloride.	Feasibility study completed. Mine open, also operating a pilot plant to produce 20,000 tons of phosphate rock. INI of Spain participating.	[illegible]
SOUTHERN PERU COPPER CORPORATION			
Botifaca concentrator	To recover 3,000 short tons per year of molybdenum from Cuajone ore.	Authorization granted by the Government and construction underway in 1979.	10

PRODUCTION

Production in 1978 and 1979 was affected by labor strikes in both years. A strike at the mines of Centromin in August and part of September 1978 caused the declines in production of lead, zinc, silver, and iron ore, as shown in table 2. Copper production in 1978 did not suffer because the Cuajone was less affected by work stoppages. In 1979 both Cuajone and Toquepala had work stoppages but in general the labor situation in 1979 was calmer.

Placer gold mining increased as a result of incentives provided by the new gold law and the increase in price.

Table 1.—Peru: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Antimony:				
Mine output, metal content	603	823	895	898
Metal	339	504	489	490
Arsenic, white	797	1,367	1,257	1,360
Bismuth:				
Mine output, metal content	521	585	[e]590	635
Metal	456	516	520	560
Cadmium:				
Mine output, metal content	360	380	[e]350	400
Metal	174	182	[e]190	220
Copper:				
Mine output, metal content	[r]220,300	341,000	366,400	[1]400,385
Copper sulfate	[r]1,030	1,311	1,228	1,300
Metal:				
Smelter	[r]188,400	321,100	318,900	[1]379,600
Refined	[r]135,600	188,100	182,754	[1]230,835
Gold:				
Mine output, metal content troy ounces	[r]79,412	104,393	103,069	122,333
Metal do	74,204	89,315	88,182	98,400
Indium kilograms	[r]3,271	3,734	3,302	3,400
Iron and steel:				
Iron ore and concentrate thousand tons	4,776	6,284	4,921	5,600
Metal:				
Pig iron do	232	244	245	265
Ferroalloys	320	[e]500	1,800	1,800
Steel ingots and castings thousand tons	349	379	377	430
Lead:				
Mine output, metal content	159,758	166,068	182,704	176,707
Metal	74,121	79,385	74,269	100,000
Manganese ore and concentrate:				
Gross weight	613	--	--	--
Metal content	164	--	--	--
Molybdenum, mine output, metal content	453	463	729	816
Selenium metal, refined kilograms	8,754	15,920	12,927	13,600
Silver:				
Mine output, metal content thousand troy ounces	35,579	39,088	37,045	[1]43,415
Metal do	19,452	22,145	20,859	20,800
Tellurium metal kilograms	12,306	18,370	15,382	15,900
Tin, mine output, metal content	273	300	1,744	1,500
Tungsten, mine output, metal content	591	526	582	500
Zinc:				
Mine output, metal content	421,310	405,384	457,500	[1]432,000
Metal	64,680	66,949	68,436	69,000
NONMETALS				
Barite	330,689	434,984	362,200	436,000
Cement, hydraulic thousand tons	1,966	1,970	2,020	2,020
Chalk	NA	NA	330,580	350,000
Clays:				
Bentonite	39,545	41,545	37,215	40,800
Fire clay	19,085	19,500	9,900	9,900
Kaolin	9,116	10,600	3,824	4,500
Common clays	328,811	380,500	[e]385,000	385,000
Diatomite	[e]18,000	18,800	16,500	19,000
Feldspar	[e]4,000	4,320	9,760	9,000
Graphite	[e]60	60	[e]60	60
Gypsum, crude	[r]171,126	215,100	238,824	217,000
Mica	9	9	58	50
Nitrogen, N content of ammonia	75,000	83,000	81,000	80,000
Phosphates, crude: Guano	2	--	--	--
Salt, all types	[e]305,000	310,440	491,491	450,000
Stone, sand and gravel:				
Dimension stone:				
Marble	NA	(2)	15,625	15,500
Slate	NA	700	700	700
Crushed and broken stone:				
Dolomite	[e]24,500	25,450	23,854	25,500
Limestone	3,144	3,550	3,314	3,600
Quartz and quartzite	6,955	[3]7,050	600	1,000
Silica thousand tons	[e]300	300	158	200
Sand and gravel do	4,052	4,481	3,448	3,500
Sulfur:				
Elemental:				
Native	593	600	280	600
Byproduct of metallurgy	16,300	20,000	18,000	20,000
Sulfuric acid, including oleum, gross weight	47,756	50,983	47,292	47,000
Talc and related materials:				
Talc	[r]2,700	[e]2,710	1,713	2,700
Pyrophyllite	11,860	[e]12,290	11,200	12,270

See footnotes at end of table.

Table 1.—Peru: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^p	1979^e
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	2,130	5,698	^e5,700	5,700
Coal:				
Anthracite	10,816	23,410	23,250	24,000
Bituminous^e	(3)	(3)	(3)	(3)
Coke, all types^e	^r10,000	10,000	10,000	10,000
Gas, natural:				
Gross million cubic feet	71,597	72,763	68,970	¹73,110
Marketed do	^e32,500	^e32,900	31,877	¹21,003
Natural gas liquids:				
Natural gasoline and other⁴ thousand 42-gallon barrels	508	493	521	¹464
Propane do	79	74	60	¹47
Butane do	7	8	7	¹9
Total do	594	575	588	¹520
Petroleum:				
Crude do	27,936	33,276	55,079	¹69,361
Refinery products:				
Gasoline:				
Aviation do	1	(3)	(3)	(1)(3)
Motor do	12,336	11,981	11,102	¹13,000
Jet fuel do	1,628	1,325	1,812	¹2,657
Kerosine do	4,990	5,017	5,538	¹6,156
Distillate fuel oil do	7,710	7,804	9,746	¹11,909
Residual fuel oil do	13,194	15,448	14,523	¹15,469
Lubricants do	108	63	70	¹77
Other:				
Liquefied petroleum gas do	1,091	1,220	1,274	¹1,237
Asphalt do	296	246	212	¹181
Unspecified do	150	217	122	303
Refinery fuel and losses do	488	505		
Total do	41,992	43,326	44,399	¹51,100

^e Estimate. ^p Preliminary. ^r Revised. NA Not available.
[1] Reported figure.
[2] Marble is included with quartz and quartzite.
[3] Less than 1/2 unit.
[4] Includes hexane.

Table 2.—Peru: Smelter and refinery production of Centromin

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979
Refined metals:				
Copper, refined	45,786	55,022	51,897	54,281
Lead, refined	74,066	79,243	74,255	85,112
Zinc, refined	64,382	66,949	62,852	69,186
Silver, fine and sterling troy ounces	19,227,701	21,572,344	20,896,528	25,408,116
Gold do	34,691	36,369	32,220	42,857
Bismuth	456	516	611	523
Cadmium	174	182	170	190
Indium kilograms	3,271	3,734	3,302	3,846
Selenium do	8,743	15,936	12,941	16,129
Tellurium do	12,306	18,370	15,418	21,133
Metals in blister copper for export:				
Copper content	5,525	1,486	--	--
Silver content troy ounces	1,230,536	303,524	--	--
Gold content do	2,215	569	--	--
Subproducts:				
Antimony, crude	315	528	488	677
Antimonial lead	44	102	9	NA
Arsenic trioxide	789	1,405	1,322	NA
Zinc power	1,517	1,592	1,486	NA

NA Not available.

Source: Centromin.

TRADE

Mineral exports in 1978 increased both in tonnage and value and, with a value of $970 million, represented 50% of all exports. Copper ranked No. 1 in export value, and silver ranked No. 2. They accounted for 42% and 21%, respectively, of the value of mineral exports. In 1979 mineral exports were valued at $1,548 million or 45% of total exports. The bulk of Peru's mineral exports is in the form of metal. However, the country still exports lead and zinc concentrates and will continue to do so even with the completion of the Cajamarquilla refinery.

In 1979, mineral exports by Minero Perú Commercial (Minpeco), the state agency in charge of marketing all Peruvian minerals, were as shown in the following preliminary data:

Commodity	Quantity (metric tons)	F.O.B. value (thousand U.S. dollars)
Refined copper cathodes	175,145.0	328,746
Refined copper bars	31,406.0	57,645
Refined copper wire rod	5,547.0	10,429
Blister copper	[1]139,613.0	247,287
Copper concentrate	[1]111,742.0	50,350
Copper cement	[1]1,784.0	2,262
Copper ores	[1]715.0	264
Total copper		696,983
Refined lead	85,531.0	95,270
Lead concentrates	[1]134,962.0	183,709
Lead ores	[1]5,861.0	2,111
Total lead		281,090
Refined silver	772.0	234,096
Refined zinc	57,292.0	38,782
Zinc concentrates	[1]693,639.0	132,420
Zinc zamac	14.0	10
Zinc sulfate	20.0	8
Total zinc		171,220
Crude antimony	102.0	204
Refined bismuth	362.0	2,001
Refined cadmium	210.0	1,173
Refined indium	3.7	1,608
Refined selenium	12.5	333
Refined tellurium	12.3	505
Arsenic trioxide	1,519.0	635
Tin concentrates	[1]2,365.0	13,711
Molybdenum concentrates	[1]2,141.0	53,365
Tungsten concentrates	[1]1,129.0	10,784
Antimony ores	[1]741.0	742
Total various products		85,061
Iron ore	[2]5,529,026.0	84,854
Total		1,553,304

[1] Dry metric tons.
[2] Dry long tons.

Table 3.—Peru: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS			
Aluminum metal including alloys:			
Scrap	--	15	All to Bolivia.
Semimanufactures	95	154	Bolivia 138; Chile 15.
Antimony:			
Ore and concentrate	579	864	Belgium-Luxembourg 580; Japan 234.
Metal including alloys, all forms	231	429	United States 284; Japan 74.
Arsenic trioxide, pentoxide, acids	50	25	Brazil 10; Chile 10; Ecuador 5.
Bismuth metal including alloys, all forms	641	512	United States 248; Netherlands 131; U.S.S.R. 100.
Cadmium metal including alloys, all forms	199	170	United States 69; Netherlands 65.
Copper:			
Ore and concentrate	44,584	63,821	Japan 26,888; U.S.S.R. 14,410; United States 7,794.
Matte	1,846	--	
Copper sulfate	144	236	Colombia 111; Guatemala 30; Venezuela 30; West Germany 24.
Metal including alloys:			
Scrap	--	20	All to Venezuela.
Unwrought:			
Blister	170,207	293,909	United States 50,805; Japan 33,149.
Refined	37	81	Venezuela 41; Belgium-Luxembourg 40.
Master alloys	10	--	
Semimanufactures	2,750	7,441	Venezuela 1,800; Colombia 1,597; Ecuador 1,429; El Salvador 850.
Gold, metal content of mixed bars thousand troy ounces	65	129	United States 52; Venezuela 22.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	4,303	6,103	Japan 3,069; United States 1,126.
Metal:			
Pig iron, including cast iron	30	--	
Semimanufactures	1,512	4,499	Bolivia 3,643.
Lead:			
Ore and concentrate	162,983	127,732	United States 40,994; Japan 31,307; Mexico 17,394.
Oxides	873	1,342	Colombia 598; Venezuela 473.
Metal including alloys:			
Scrap	68	--	
Unwrought	85,431	97,749	United States 42,760; Italy 15,097; U.S.S.R. 10,999.
Semimanufactures	31	40	All to Ecuador.
Manganese metal	1	--	
Molybdenum ore and concentrate	814	1,061	Netherlands 584; West Germany 159; United States 110; Sweden 108.
Nickel metal including alloys, semimanufactures	--	81	All to Netherlands.
Platinum-group metals and silver:			
Ores and concentrates	4	8	France 2; Israel 2; West Germany 1; Italy 1; United States 1.
Metals including alloys:			
Platinum-group troy ounces	289	--	
Silver thousand troy ounces	21,526	25,000	United States 15,515; Netherlands 3,084.
Selenium, elemental	7	10	Netherlands 4; United States 2.
Tellurium, elemental	26	23	United States 19; Netherlands 3.
Tin:			
Ore and concentrate	759	754	United Kingdom 562; United States 192.
Metal including alloys, all forms	37	52	Ecuador 26; Nicaragua 10; Venezuela 7.
Tungsten ore and concentrate	1,137	977	Japan 449.
Zinc:			
Ore and concentrate	665,283	610,728	Japan 208,670; Italy 98,026; France 71,253.
Oxide	382	591	Colombia 274; Ecuador 150; Bolivia 64.
Metal including alloys, all forms	76,144	79,460	United States 21,248; Brazil 19,170; Italy 7,265.
Other:			
Ash and residue containing nonferrous metals	--	1,200	All to Netherlands.
Oxides, hydroxides, peroxides of metals	250	148	Brazil 126; United States 18.
Metals including alloys, all forms	5	3	Mainly to United States.
NONMETALS			
Abrasives: Pumice, emery, natural corundum, etc	1	--	
Barite and witherite	367,075	364,432	United States 246,119; Netherlands 43,211.
Boron: Crude natural borates	2,715	788	Brazil 499; Colombia 180; United States 108.
Cement, hydraulic	2,217	34,255	Ecuador 26,552; Bolivia 7,544.
Chalk	170	79	All to Ecuador.
Clays and clay products (including all refractory brick):			
Crude: Bentonite	897	986	Colombia 755; Ecuador 231.
Products	355	314	Ecuador 147; Bolivia 95; Venezuela 34.
Fertilizer materials, manufactured	67	4	All to Bolivia.
Gypsum and plasters	77	2,651	All to Ecuador.
Lime	1,024	--	

See footnotes at end of table.

Table 3.—Peru: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
NONMETALS —Continued			
Precious and semiprecious stones	(1)	7	Netherlands 5; Israel 1; United States 1.
Pyrite, gross weight	--	4	Ecuador 1; France 1; West Germany 1; United States 1.
Salt and brines	185	65	All to Ecuador.
Sodium and potassium compounds: Caustic soda	--	6,010	All to Colombia.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	349	388	Do.
Worked	--	(1)	All to Bolivia.
Quarts and quartzite	--	2	Italy 1; United States 1.
Sand, excluding metal bearing	--	48	All to Bolivia.
Sulfur, elemental, other than colloidal	2	--	
Talc	--	23	All to Ecuador.
MINERAL FUELS AND RELATED MATERIALS			
Coal and briquets	--	99	All to Chile.
Petroleum:			
Crude thousand 42-gallon barrels	2,738	638	Brazil 394; Argentina 244.
Refinery products:			
Gasoline do	3	1,048	United States 693; Greece 193; Ecuador 162.
Residual fuel oil do	247	2,472	United States 1,780; Switzerland 374.
Lubricants do	68	45	NA.
Other:			
Liquefied petroleum gas do	15	16	Panama 14; Ecuador 2.
Unspecified do	(1)	(1)	Mainly to Bolivia and Ecuador.
Total do	333	3,581	

NA Not available.

[1] Less than 1/2 unit.

Table 4.—Peru: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS			
Aluminum:			
Bauxite and concentrate	2,229	3,846	All from Guyana.
Oxide and hydroxide	1,434	2,380	West Germany 1,945; Brazil 220.
Metal including alloys, all forms:			
Unwrought	3,716	5,228	Venezuela 3,937; Canada 853.
Semimanufactures	2,536	1,798	United States 563; France 393; West Germany 214.
Antimony metal including alloys, all forms	--	1	Mainly from Japan and West Germany.
Arsenic trioxide, pentoxide, acids	(1)	--	
Chromium:			
Ore and concentrate	1,066	2,575	Mainly from United States.
Oxide and hydroxide	34	24	West Germany 8; United States 7; Italy 5; Belgium-Luxembourg 2; United Kingdom 2.
Metal including alloys, all forms kilograms	--	2,736	United States 1,661; France 1,065.
Cobalt oxide and hydroxide	(1)	(1)	All from United States.
Copper:			
Copper sulfate	2	(1)	All from West Germany.
Metal including alloys:			
Unwrought	4	4	Mainly from West Germany.
Semimanufactures	--	791	Chile 191; United States 126; West Germany 103; Netherlands 99; Japan 87.
Iron and steel:			
Ore and concentrate	22	56	United States 47; Switzerland 6.
Metal:			
Scrap	22,061	--	
Pig iron, ferroalloys, similar materials	749	3,448	Republic of South Africa 1,800; Brazil 1,022.
Steel, primary forms	1,625	29,167	France 17,804; West Germany 7,525; Belgium-Luxembourg 3,202.
Semimanufactures:			
Bars, rods, angles, shapes, sections	23,862	23,583	Japan 13,019; West Germany 6,017; United States 2,337.
Universals, plates, sheets	66,792	49,637	Japan 15,797; France 14,260; Canada 11,696; United States 6,485.

See footnotes at end of table.

Table 4.—Peru: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Semimanufactures —Continued			
Hoop and strip	3,125	2,671	Japan 1,572; United States 657; West Germany 270.
Rails and accessories	4,042	3,122	United Kingdom 1,959; United States 416; Belgium-Luxembourg 401.
Wire, excluding wire rod	3,776	3,451	Japan 1,765; West Germany 526; Belgium-Luxembourg 492.
Tubes, pipes, fittings	38,296	37,791	Japan 16,567; United States 10,141; France 8,694.
Castings and forgings, rough	5,279	2,034	United States 1,407; Colombia 307.
Lead:			
Oxides	20	1	All from United States.
Metal including alloys, all forms	(1)	7	United Kingdom 6; United States 1.
Magnesium metal including alloys, all forms	10	8	United States 6; West Germany 2.
Manganese oxide	1,527	2,059	United States 1,177; Japan 523; Mexico 247.
Mercury 76-pound flasks	270	426	All from United States.
Nickel metal including alloys, all forms	3	147	United States 78; West Germany 52.
Platinum-group and silver metals including alloys:			
Platinum-group troy ounces	55	1,318	Mainly from U.S.S.R.
Silver do	1,157	322	All from United States.
Rare-earth metals oxides	6	1	Mainly from United States.
Tin:			
Oxides	1	(1)	Mainly from Italy.
Metal including alloys, all forms	230	563	Bolivia 392; Japan 101; United States 70.
Titanium oxide	247	210	West Germany 83; Belgium-Luxembourg 62; United Kingdom 28.
Tungsten metal including alloys, all forms	8	2	Mainly from United States.
Zinc:			
Oxides	5	4	Mainly from West Germany.
Metal including alloys, all forms	115	29	United States 21; West Germany 4; United Kingdom 3; Belgium-Luxembourg 1.
Other:			
Ores and concentrates	92	156	All from Australia.
Oxides, hydroxides, peroxides of metals	66	69	United States 50; West Germany 14.
Metals including alloys, all forms	29	4	Spain 2; Republic of South Africa 1; United States 1.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	108	99	United States 53; Netherlands 21; West Germany 11; Brazil 10.
Grinding and polishing wheels and stones	78	67	West Germany 13; Mexico 13; Colombia 12; United States 8.
Asbestos	7,329	3,937	Canada 3,168; U.S.S.R. 722.
Barite and witherite	16	4	All from West Germany.
Boron materials:			
Crude natural borates	--	10	All from United States.
Oxide and acid	101	78	United States 65; United Kingdom 8.
Cement	82,684	6,885	Colombia 5,000; United States 1,419.
Chalk	10	42	All from Belgium-Luxembourg.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	850	876	Mainly from United States.
Kaolin	1,028	3,387	United States 3,143.
Other	987	1,007	United States 310; United Kingdom 304; Brazil 139; Japan 117.
Products	7,340	8,852	Colombia 2,291; West Germany 1,906; United States 1,717; Austria 1,452.
Cryolite and chiolite	--	1	All from West Germany.
Diamond, all grades value, thousands	$82	$169	Belgium-Luxembourg $106; United States $42; Republic of South Africa $21.
Diatomite	1,357	1,350	Mexico 1,142; United States 190.
Feldspar and fluorspar	2,085	1,256	Mexico 986.
Fertilizer materials, manufactured:			
Nitrogenous	57,231	151,934	Romania 56,238; United States 33,535; West Germany 17,891.
Phosphatic	--	11,995	All from United States.
Potassic	15,108	32,507	West Germany 22,000; United States 5,507; Netherlands 5,000.
Mixed	209	7,140	United States 6,991.
Graphite, natural	39	25	Japan 17; West Germany 6.
Gypsum and plasters	703	254	United States 213; Japan 41.
Magnesite	19	1,364	Mainly from Brazil.

See footnotes at end of table.

Table 4.—Peru: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
NONMETALS —Continued			
Mica:			
Crude, including splittings and waste	73	66	United States 55; Switzerland 6.
Worked, including agglomerated splittings	5	3	United Kingdom 1; United States 1.
Pigments, mineral, including processed iron oxides	406	363	West Germany 281; United Kingdom 55.
Precious and semiprecious stones, except diamond value	33,503	--	
Salt	258	201	United States 128; United Kingdom 60.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	186	1,229	United States 777; Poland 312; Italy 135.
Caustic potash, and sodic and potassic peroxides	107	157	West Germany 139.
Soda ash	25,156	21,517	United States 19,051.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	836	543	All from Italy.
Worked	69	35	Do.
Dolomite	--	13	All from Uruguay.
Gravel and crushed rock	3	33	United States 24; Japan 9.
Quartz and quartzite	27	45	United States 26; West Germany 14; Belgium-Luxembourg 5.
Sand, excluding metal bearing	4,553	4,031	United States 3,996.
Sulfur:			
Elemental:			
Other than colloidal	4,[illegible]	7,990	Venezuela 4,706; United States 3,284.
Colloidal	4	3	United States 2; West Germany 1.
Sulfur dioxide	--	38	United States 34; Chile 4.
Sulfuric acid	1	35,745	All from Japan.
Other:			
Slag, dross, and similar waste, not metal bearing	33	151	All from United States.
Oxides and hydroxides of magnesium, strontium, barium	125	205	Mexico 101; United Kingdom 43; United States 27.
Bromine, iodine, fluorine	3	3	Chile 2; France 1.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	25	10	Mainly from United States.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	279	25	United States 19; West Germany 6.
Carbon black and gas carbon	2,836	1,768	Colombia 694; Venezuela 673; Canada 205.
Coal and briquets:			
Anthracite and bituminous coal	20,078	50,515	All from United States.
Lignite and lignite briquets	90	189	Do.
Coke and semicoke	84,084	137,662	Japan 117,430; France 20,015.
Gas, hydrocarbon	5,772	16,[illegible]48	Mainly from Netherlands Antilles.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	20,780	16,914	Equador 11,975; Venezuela 4,939.
Refinery products:			
Gasoline:			
Aviation do	280	95	All from Venezuela.
Motor do	54	33	Venezuela 18; Brazil 15.
Kerosine do	132	--	
Jet fuel do	860	1,598	Mainly from Venezuela.
Distillate fuel oil do	964	2,678	Venezuela 2,247.
Residual fuel oil do	51	130	All from Venezuela.
Lubricants do	402	329	Venezuela 178; Netherlands Antilles 132.
Other:			
Nonlubricating oils, n.e.s. do	4	5	Netherlands 2; United States 2; Sweden 1.
Mineral jelly and wax do	40	109	Taiwan 56; Japan 40.
Pitch do	(1)	--	
Bituminous mixtures, n.e.s do	(1)	(1)	Mainly from Venezuela.
Unspecified do	(1)	--	
Total do	2,787	4,977	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	902	504	United States 253; United Kingdom 129; Netherlands 81.

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Copper.—As a result of strikes, the projected production goal of 380,000 metric tons in 1978 was not achieved but was surpassed in 1979, reaching 400,385 metric tons. Production of contained copper by the principal segments of the industry in 1978 and 1979 were as follows:

	1978	1979
Total contained copper production	366,400	400,385
Principal producers:		
Southern Peru Copper Corp	283,064	291,073
Centromín (from its own mines)	25,911	ᵖ30,500
Minero Peru (from Cerro Verde Mine)	28,426	33,100

ᵖPreliminary.

Minero Peru received renewed proposal from Klöckner Industrie Anlage of the Federal Republic of Germany and Marubeni of Japan for Phase I of the expansion program envisaged for the Cerro Verde Stage II deposit, to produce 60,000 tons of contained copper. Minero Peru also carried out negotiations in 1979 with Bureau de Recherches Géologiques et Minières (BRGM) of France, Billiton International Metals B.V. of Netherlands, and Outokumpu Oy, of Finland to develop the Tintaya copper deposit.

Centromín's plan for copper call for the expenditure $20 million in 1979, $77 million in 1980 and $70 million in 1981.[2] The funds will be used for the expansion of the Cobriza copper mine and the copper refinery of La Oroya.

The Agila copper mine at Huarás, 250 kilometers north of Lima, started production in 1978. The mine hopes to produce 10,000 to 12,000 tons of contained copper per year. The copper concentrate will be shipped by pipeline and truck to Chimbote port for export.

Gold.—With the dramatic gold price increase and the Government's reduction of taxes on private mine developers in May 1978, the gold boom initiated in 1978 continued throughout 1979, especially in the placer gold area of Madre de Dios in the southeastern jungle region. The Banco Minero del Perú, which has the monopoly on all gold trading in Peru, increased its purchases from 90,295 ounces in 1978 to 113,022 ounces in 1979.

Over 50% of gold production is from Centromín's La Oroya refinery and the company retained its No. 1 position as Peru's gold producer. The remainder of the production is from placers and the small Ocoña lode gold mine in the Department of Arequipa. Gold production by Centromín, by sources, in 1978 and 1979 were as follows:

	1978	1979
In ores and concentrates	12,860	17,006
In blister	16,075	12,867
Refined	32,183	42,867
In placer gravels	46,008	50,412
Total	107,126	122,30

The Madre de Dios area accounted in 1979 for 90% of placer gold, which was the largest single source of Peru's gold production. Although, in this area a few modest producers are active, the bulk of the gold is produced by many individual entrepreneurs who work with hand tools and small water pumps and sluices. Peruvian and United States interests who own the Roberto 24 concession, on the Madre de Dios River north of the Island of Laberinto, were in the development stage of removing the overburden. They were planning on a medium-size mechanized operation of around 100 cubic meters per day. In addition, a group of Swiss and Peruvians were carrying out exploration in the Huepetue and Colorado Rivers with the idea of eventually setting up a completely mechanized operation, probably with dredges. Another Peruvian-United States group is exploring with very encouraging results, in the Puquibe River, which will probably turn out to be a large operation.

The Government-owned Centromín continued its exploration between the Madre de Dios and Inambari Rivers with encouraging results. Existence of a gravel horizon with gold, tin, and chromite has been established.

The only other large gold mining project is San Antonio de Poto in Puno in the far south, which Minero Perú was planning to develop through a special mining company with local and foreign investors. However, negotiations with Oro Sur, a company formed by private Peruvian investors, and St. Joe Minerals Corp. fell through when the Government reintroduced a 17.5% export sales tax, which caused St. Joe to reconsider any new investment plans. Minero Perú has now decided to develop the project alone and has contracted SIMA, the Peruvian Navy Industrial Service, to evaluate the cost of raising a dredge that sunk back in 1972 when the concession was being worked by Natomas Co. of California.

In addition to gold placer mining, there are several small underground operations, some of which have now become feasible owing to the present price of gold. The old Cochasayhuas gold mine in Apurímac and the old Sucuytambo, now known as "Nora Maria," in Arequipa, containing silver and gold, are currently being reactivated. Moreover, the Arias group, which controls a large number of mines in the country, is interested in opening a new gold prospect in the Pataz area, 300 miles north of Lima in the mountains, Department of La Libertad, east of the Marañón River. It calls for an investment of $3 million, which includes the installation of a 200-metric-ton-per-day mill, the opening of a 35-kilometer access road, and the acquisition of electric diesel power and mine equipment. The company expects the new mine to go into production in about 2 years.

Because "non-traditional" exports, in this case jewelry, were given export subsidies, domestic sales, mainly to jewelers for fabrication and export, increased. Exports of gold bullion, therefore, decreased in 1979 from 89,121 ounces valued at about $16,956 million in 1978 to 49,100 ounces worth $13,024 million in 1979. Gold shipments in 1979 went entirely to Venezuela and the United States.

Iron Ore.—During 1979, the State-owned Hierro del Peru, the only iron ore producer, obtained a number of loans for buying trucks, desalinization units for improving the quality of the pellets produced, and has plans to buy additional equipment in 1980. By yearend, the company started production of pellets using fresh water from two desalinization units. Hierro del Perú's production by categories was as follows, in dry long tons:

	1978	1979
Pellets	2,102,530	1,755,900
High-grade sinter feed	1,457,880	1,922,430
Pellet feed in slurry form	506,090	521,458
Pellet feed in filter cake form	777,200	1,158,370
Total	4,843,700	5,358,158

Iron ore exports in 1979 totaled 5,513,772 dry long tons; of which 2,365,940 went to Japan and 1,249,470 went to the Republic of Korea; smaller quantities were shipped to the United States (491,140 dry long tons) and a few other countries.

Lead and Zinc.—Centromín, the dominant lead and zinc producer of Peru, accounted for about 38% of zinc and 42% of total lead production. Centromín's main investment in its lead-zinc operations was the modernization of the La Oroya refinery. The strike against 15 medium-size mining companies resulted in a production decline by this sector of the industry in 1978.

Activities in the private sector of the industry included the construction of a new 1,800-metric-ton-per-day concentrator by Cía. Minera Milpo S.A., which started operation in August 1979, the expansion of ore production from 460 to 750 metric tons per day in the Alianza lead/zinc deposit located in Ancash, the expansion of Cía. Mínera San Ignacio de Morococha S.A.'s mine from 1,500 to 2,000 metric tons per day of ore, and the development of the Contoga zinc deposit of Sociedad Minera de Gran Bretaña S.A. to produce about 200 tons per day of ore. These expansion plans have contributed to the production increase noted in 1979. Promotora de Negocios Mineros Perú S.A., 71% owned by Milpo, completed geological and feasibility studies of the Colladare polymetallic prospect.

Molybdenum.—The major molybdenum producer in Peru is Southern Peru Copper Corp. from its Toquepala Mine, which in 1979 produced 1,980 metric tons of molybdenite containing 1,787 metric tons of MoS_2, a substantial increase from the 1,216 metric tons MoS_2, in 1978. Cía Minera Turmalina, a small operation in northern Peru, produced about 30 metric tons of concentrates containing 24 metric tons of molybdenite, making a total of 1,811 metric tons of molybenite in 1979.

Cía. Minera Turmalina is currently exploring the Ricrán molybdenum deposit in the central mining district (Department of Junín). Amax Exploration, Inc., of Denver, Colo. has obtained an option on the Pashap copper-molybdenum deposit located in the Province of Huaylas, Department of Ancash in northern Peru, having initiated a drilling program in 1979. The deposit was previously explored in 1973.

Molybdenum production should be increasing considerably starting in 1980 if the Cuajone molybdenum concentrator currently under construction goes onstream by mid-1980 as scheduled.

Silver.—Silver exports in 1978 and 1979 valued at $207 million and $394 million, respectively, ranked second in value in Peruvian exports; the 1978 exports accounted for 11% of all exports by value. Centromín, the largest producer (20.4 and 25.5 million ounces in 1978 and 1979, respectively), was followed by Cía. de Minas Buenaventura S.A. (4.35 million ounces in 1979), and Minas de Arcata S.A. (1.8 million ounces in 1979). Buenaventura owns four mines: Julcani and Huachocolpa in the Department of Huancavelica in Central Peru; Orcopampa in the Department of Arequipa; and Uchucchacua, 120 kilometers northeast of Lima. The company completed expansion at the Uchucchacua Mine in 1979. The companies operating Huarón and Alianza mines and Cía. Minera Milpo S.A., listed among the lead zinc producers, were other important silver producers.

The high silver prices increased exploration and production. Primary examples are reactivation of the Salpo silver deposit near Quiruvilca; exploration of the "El Extrano" lead-silver-zinc deposit in Ancash Department and the Auquichani silver deposit on the continental divide near Lima; start of production in 1979 at the Farallón polymetallic mine; and the reactivation (in 1977) of the old Cacachara lead-silver mine.

Cía. Minera Condesa S.A., one of Buenaventura's subsidiaries, acquired an important group of mining concessions close to the town of Huachocolpa, in the Department of Huachocolpa southeast of Lima, containing mineralized veins with high silver content. Moreover, Condesa in association with Cía. Minera Caudalosa S.A., and Cía. Minera Castrovirreyna S.A. are participating in the Cía.. Minera Chonta S.A., which was formed recently to develop the Rublo Mine in the Huachocolpa region.

Tungsten.—In addition to Centromín, Peru's principal tungsten producer from the San Cristóbal Mine, and Fermin Malaga Santolalla e Hijos Negoc. Minera, which produces tungsten from the old Pasto Bueno Mine, Soc. Minera Regina S.A. produced 150 tons of tungsten concentrate (67% WO_3) from the Regina Mine, which the company has started to develop. The Regina Mine is located in southern Peru, northeast of Juliaca. Soc. Minera Puquio Cocha S.A. also recovered tungsten from tailings accumulated over 30 years from a copper concentrator. Small tonnages were produced by Tungsteno Peruano S.A., a Canadian firm operating a small deposit in Ancash, and Cía. Minera Turmalina. Production by companies in 1978 and 1979 was as follows, in metric tons of WO_3 content:

	1978	1979
Centromin	424	[illegible]
Malaga Santolalla	196	[illegible]
Small producers	114	[illegible]
Total	734	[illegible]

NONMETALS

Barite and cement were the principal nonmetallic commodities produced in Peru. The status of the industry and producers was unchanged from that of 1977. Expansion of the Pacasmayo cement plant of Cementos del Norte Pacasmayo S.A. to increase capacity from 1,000 to 3,000 tons per day has been completed and is reflected in the higher production in 1979.

Fertilizer Materials.—*Nitrogenous.*—The refineries of Petroleos del Peru produce urea by processing refinery gases. Urea production since 1975 was as follows, in metric tons:

Year	Quantity
1975	47,[illegible]
1976	10[illegible]
1977	117,[illegible]
1978	112,[illegible]

Phosphatic.—The National Institute of Industry of Spain completed a feasibility study of the Bayóvar phosphate. The study envisages a $300 million investment to produce the following, in tons per year:

Phosphoric acid	213,000
Sulfuric acid	[illegible]
Potassium chloride	[illegible]
Triple superphosphate	[illegible]

MINERAL FUELS

Coal.—The world energy situation stimulated interest in coal in Peru in recent years. In early 1978 the Government created a commission to draft plans for utilizing the country's coal resources. One of the conclusions of the energy symposium in June 1979 was that an entity should be chosen to evaluate and promote the development of Peru's coal resources for domestic use and export. It is hoped to increase the contribution of coal to the total energy supply from the present level of 0.5%.

Developments in the coal industry during 1978 and 1979 were as follows: Centromín in 1978 reopened the old Goyllarisquizga deposit and reportedly started a modest production in 1979. A coal-washing plant with a daily capacity of 300 tons is also being installed. Centromín plans also to start exploration and diamond drilling for coal in the Jatunhuasi area, located in Cachi 45 kilometers northwest of Huancayo, and planned to do some diamond drilling to locate coking coal.

Minero Perú's coal activities were concentrated on the Alto Chicama anthracite seams. The anthracite would be used for the 480-megawatt powerplant to be built by KOPEX-Universal, a Polish-Swiss consortium working on the project. The consortium submitted its feasibility study in November 1978.

Empresa Siderúrgica del Perú (Siderperú) is exploring the Oyon area with means to install a coking plant. Within Siderperu's short term expansion program, it is considering a direct-reduction furnace and a thermal power station using anthracite coal from the Santa Valley in northern Peru.

Private industries were also active. Combustibles Solidos S.A. was reported to have contracted to export 80,000 tons of anthracite from the Santa Valley region, with the first shipment to start in 1979. The coal would come from the Ancos Mine and small producers in the area.

Petroleum and Natural Gas.—Two new oil contracts were signed in 1978, one with Occidental Petroleum Co. to exploit heavy crude in Block 1-B adjacent to Occidental's existing fields (Block 1-A) in the eastern jungle. The second contract was with Occidental and Bridas S.A. of Argentina for secondary recovery in a cluster of 11 fields in the Lobitos-El Alto/Los Organos area on the west coast. Secondary recovery from these fields is expected to reach 38,000 barrels per day by 1984. The major event in 1979 was a publication by the Government of guidelines to govern existing and future oil contracts with foreign companies, and tax regimes applicable to all contracts. The guidelines set limits on areas of exploration and number of blocks a company may explore. These contracts would be either service contracts or operations contracts to be valid for a maximum of 30 years (exploration and exploitation). The contractors will be compensated for their services by Petroperú either in a negotiated amount of cash, in cash according to volume and value of production, or in crude in an amount proportional to the volume of production.

Production.—The increase in crude production in 1978 resulted from the completion of the northern spur pipeline linking Occidental's fields in the eastern jungles to the Trans-Andean pipeline (completed in 1976). Production in 1979 increased again as a result of expansion by Occidental's field in the jungle area and of increased secondary recovery in the coastal fields. By yearend 1978, the Trans-Andean pipeline was transporting 125,000 barrels of crude per day. In 1978, the jungle fields, with an average daily production of 92,000 barrels, accounted for 61% of output followed by the coastal fields (20%) and the continental shelf (19%). Corresponding 1979 figures were 67% for the jungle (128,782 barrels per day), 18% for the coast (34,539 barrels per day), and 15% for the continental shelf (28,325 barrels per day).

The producing companies were as follows:

Company	Fields	Production (thousand barrels)	
		1978	1979
Occidental	Eastern jungle area	23,492	38,756
Petroperú	Eastern jungle and the Talara coastal fields.	21,298	18,685
Belco	Offshore fields in blocks Z - 1A and Z - 2A.	10,287	10,339
Occidental Bridas[1]	Secondary recovery in Lobitos and El Alto/Los Organos area.	1,114	2,171
Total		55,191	69,951

[1]Started operation in April 1978.

The northeastern and central jungle fields continued as dominant producers.

	Production (thousand barrels)	
	1978	1979
Northeastern fields:		
Occidental	23,492	38,756
Petroperú	9,513	7,784
Central fields:		
Petroperú	521	466
Total	[1]33,527	47,006

[1]Total may not agree because of rounding.

Reserves.—By yearend 1978, proven reserves under development by the above companies were reported to total 715 million barrels divided as follows: Occidental-350, Petroperú -305, and Belco-60.

In addition, Royal Dutch Shell carried out technical studies on a jungle area in the Marañón basin, Sun Oil Co. showed interest in the central Ucayali basin, and MAPCO and Petroperú held preliminary discussions on secondary recovery.

Consumption and Trade.—Peru consumed 120,428 barrels per day of petroleum in 1978 and 126,016 in 1979. Crude exports in 1978 and 1979 were 10.7 million and 19 million barrels, respectively. The total value of crude and byproducts exports nearly tripled from $192 million in 1978 to $719 million in 1979. Peru also imported petroleum products: 2,144,000 barrels in 1978 and 17,755,000 in 1979, with f.o.b. values of $34.5 million and $16 million, respectively.

To keep petroleum product prices in line with international levels, the Government increased prices in 1979. In local currency these price increases were 30% to 50% above the 1978 levels. However, because of the depreciation of the sol, the increases in dollar prices were close to 10%. Gasoline costs about 90 cents per gallon; prices for some of the other products in U.S. cents were domestic kerosine-$0.10; diesel No. 1-$0.41; and residual fuel oil-$0.32.

Refining.—During 1978 and 1979, Petroperú continued operating four refineries. Crude processed by the refineries in 1978 and 1979 was as follows:

Refinery	Location	Capacity (barrels per day)	Crude processed (thousand barrels)	
			1978	1979
Talara	Northern Peru	65,000	20,566	[illegible]
La Pampilla	Lima	100,000	22,349	[illegible]
J. L. Diaz	Iquitos	1,400	408	[illegible]
Pucallpa	Central Jungle	2,500	579	[illegible]

In late 1979, the Ministry of Energy and Mines approved construction of a 10,500-barrel-per-day refinery at Iquitos to meet the needs of the jungle marketing area. The new refinery, which will replace the small topping plant, is scheduled to come onstream by 1982. The plan for the construction of a 150,000-barrel-per-day refinery in Bayóvar has been postponed.

The Talara refinery produced 112,858 tons of urea in 1978 and 109,200 tons in 1979. This plant also produces carbon black, which Peru started exporting in 1979.

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[1]Physical scientist, Branch of Foreign Data.

[2]Engineering and Mining Journal. June 1979, p. 278.

The Mineral Industry of the Philippines

By E. Chin[1]

The Philippines is a commodity-exporting country, earning most of its foreign exchange from exports of agricultural and forestry products, animal foodstuffs, and minerals. Despite the mounting annual trade deficit-$1.2 billion in 1978 and $1.5 billion in 1979-the gross national product (GNP) rose 22.2% from $23.9 billion in 1978 to $29.2 billion in 1979 at current market prices.[2] In terms of constant prices (1972 pesos), real growth in GNP was only 6%, from a GNP of $11.1 billion in 1978 to $11.8 billion in 1979.[3]

The mineral output value of the Philippines in 1979 was estimated at $1.3 billion, compared with $0.8 billion in 1978, representing only 4.4% and 3.3% of the GNP, respectively.[4] The value added for the production of refined minerals and metals was not included in the output value inasmuch as the bulk of the mining output is exported for overseas processing.

The minerals sector was an important component in overall trade, accounting for 28% of total export value in 1979 and 24% in 1978. In terms of imports, mineral fuels alone accounted for 28% of all imports in 1979, with receipts of base metals, 9%, and metal manufactures, 2%. Receipts of nonmetallic commodities (chemicals, fertilizers, and nonmetal manufactures) were valued at $576 million in 1979, or 9% of total imports.

There was increased production in 1979 of copper, chromite, cement, and the other major mining products except gold and nickel. The minerals sector was buoyed both by higher demand and by higher world prices for precious and base metals. Although gold prices exceeded $500 per ounce before yearend 1979, output of both primary and secondary gold was below the 1978 level of production.

Presidential Decree (PD) No. 1677 was promulgated in 1979, amending certain sections of PD 463 (Mineral Resources Development Decree of 1974). PD 1677 obligates owners of mining claims to place mining properties into production in 5 years; failure to do so would result in automatic abandonment of the mining claims. Holders of existing mining leases are required to submit a revised or updated work program and are obligated to submit proof of compliance with annual work obligations. Deviation from the submitted work plan was to be subject to approval by the Philippine Bureau of Mines. The main purposes of the Decree were to speed development of mining claims and to eliminate speculation by claim owners.

In September 1979, the President of the Philippines proposed the acceleration of its industrialization program, which encompassed 11 major projects totaling $6 billion. Objectives envisioned in the program included the establishment of 12 inductrial export processing sites during the next 5 years to earn up to $500 million annually, introduction of tariff reforms to promote free and competitive trade, creation of new industries, modernization of existing industries, and financial assistance for small- and medium-size firms. Projects related to the mining sector included construction of an aluminum smelter, a copper smelter, an integrated steel mill, and a phosphate fertilizer plant, expansion of the cement industry, and establishment of two downstream petrochemical projects.

Philippine 1979 energy needs were estimated at 91.9 million barrels of oil equivalent (BOE). Imported petroleum accounted for 81.4%, or 74.8 million BOE, of the consumption in 1979, down from 81.5 million BOE in 1978. Configuration of domestically produced energy was as follows: Petroleum, 10% (9.2 million BOE); hydropower, 6.4% (5.8 million BOE); geothermal, 1.5% (1.3 million BOE); coal, 0.8% (0.7 million BOE); and other, 0.01% (0.006 million BOE). Geothermal production in 1979 was 223 megawatts and was scheduled to double in 1980 to about 480 megawatts. Three 60-megawatt hydropower units of the Argus River project in Mindanao came onstream in 1979. No other major hydroelectric projects were slated for completion in the Luzon grid until 1982.

Petroleum import cost was $1.4 billion in 1979 and was expected to exceed $2 billion in 1980. Because of difficulties at the Nido field near Palawan Island, petroleum production stabilized at a flow rate of 40,000 barrels per day (bpd), dropping, however, at the end of the year to 21,300 bpd. The Nido field was opened in April 1979 and was to be followed by the development of the Cadlao and Matinloc fields in 1980.

The Philippine Bureau of Mines projected an average annual growth rate of 13.3% for the mining sector during 1980-85. Copper mining and beneficiating was to remain the largest contributor and was to reach a growth rate of 16% as new mines and expansion programs became operational in 1980. Gold production was to parallel the trend for copper with metallic output targeted to reach 1 million ounces in 1983. The ratio of traditional mineral commodity exports to total export was to decrease to 14% by 1983, in line with the national effort to promote exports of manufactured goods rather than raw materials. The Bureau of Mines was to provide guidance and coordination of all Government efforts in mining exploration and development down to the local level. Additionally, it will conduct geologic surveys; expedite the granting of mineral rights; provide geologic, mining, and metallurgical research assistance; and monitor information to promote and foster exploitation.

Under the authority of Presidential Decree No. 1654, the Philippine Bureau of Mines was renamed the Bureau of Mines and Geo-Sciences effective December 14, 1979.

PRODUCTION[5]

The Philippine Bureau of Mines estimated the total value of mineral production at $1,288 million in 1979, compared with $823 million in 1978. The large increase in value was attributed to the rise in prices for major mineral commodities rather than to a significant increase in quantity output. The value of metal mining output in 1979 was $852 million ($564 million in 1978), and for nonmetallic minerals, $436 million ($259 million in 1978).

The Philippines is the largest producer of copper in the Orient, and the value of output of ore and concentrate totaled $468 million, or 38% of the total output by the mining sector. Production of cement was valued at $282 million, followed by gold, $141 million; nickel, $112 million; sand and gravel, $86 million; cobalt, $67 million; and chromite, $39 million. Production of other metal values in 1979 included silver ($15 million), molybdenum and zinc ($4 million each), and lead ($2 million). In the nonmetallic sector, salt production in 1979 was valued at $19 million and silicon sand, $4 million.

Coal production increased 38% in value from $6 million in 1978 to $8 million in 1979. Beginning in 1980, it was expected that petroleum production would be an increasingly significant input for the minerals sector.

Table 1.—Philippines: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Chromium: Chromite, gross weight:				
Metallurgical grade	120,761	136,173	139,218	140,000
Refractory grade	310,302	402,126	398,080	422,000
Total	431,063	538,299	537,298	562,000
Cobalt, mine output, metal content	492	1,084	1,192	1,300
Copper, mine output, metal content	237,598	272,792	273,300	296,000
Gold troy ounces	501,210	558,235	586,598	[2]546,536

See footnotes at end of table.

Table 1.—Philippines: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS —Continued				
Iron and steel:				
Iron ore and concentrate thousand tons	571	--	2	2
Ferroalloys: Electric-furnace ferrosilicon[e]	7,500	15,000	14,000	18,000
Crude steel thousand tons	393	364	276	397
Lead, mine output, metal content	4,530	3,695	1,696	2,000
Manganese ore and concentrate, gross weight	10,576	20,599	3,911	3,600
Molybdenum, mine output, metal content	--	--	23	110
Nickel:				
Mine output, metal content	[e]16,000	36,781	31,046	36,000
Metal, smelter	15,239	21,873	18,700	21,300
Silver, mine output, metal content thousand troy ounces	1,481	1,621	1,668	[2]1,824
Zinc, mine output, metal content	11,643	12,442	9,330	9,670
NONMETALS				
Barite	3,199	5,393	5,548	5,400
Cement, hydraulic thousand tons	4,504	4,423	4,641	4,600
Clays:				
Bentonite	2,117	2,279	1,569	1,800
Red	8,284	18,737	12,271	12,000
White	[r]13,159	11,854	6,040	6,000
Rock	1,498	913	373	400
Other	472,370	400,354	501,694	500,225
Feldspar	15,240	15,073	17,206	18,000
Gypsum and anhydrite:				
Natural	2,820	1,710	[e]1,700	--
Synthetic[e]	[r]115,000	[r]110,000	110,000	110,000
Lime	27,086	28,184	33,281	36,000
Nitrogen: N content of ammonia[e]	80,000	80,000	80,000	80,000
Phosphate:				
Guano	1,757	162	801	NA
Phosphate rock	11,923	10,323	977	1,000
Perlite	1,649	1,864	2,153	1,800
Pyrite and pyrrhotite (including cuprous), gross weight	166,331	108,523	110,774	120,000
Salt, marine	203,386	200,000	52,553	53,000
Sand and gravel:				
Alumina sand	12,601	18,040	31,414	35,000
Glass sand thousand tons	391	320	369	400
Other[3] thousand cubic meters	6,113	7,347	NA	NA
Stone:				
Dacite	12,680	20,224	18,841	20,000
Diorite	105,835	97,841	90,128	90,000
Dolomite	6,432	7,442	7,600	8,000
Limestone thousand tons	[r]6,944	6,333	9,230	9,000
Marble (dimension), unfinished cubic meters	4,140	1,390	7,814	8,000
Sandstone	75,005	67,612	91,337	91,000
Tuff	77,123	58,574	90,493	90,000
Crushed, broken, other thousand cubic meters	[r]2,133	1,572	3,793	4,000
Sulfur, S content of pyrite	77,344	50,463	51,000	55,000
Talc	1,411	1,200	4,061	4,500
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades	120,810	284,554	313,000	300,000
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	15,381	15,234	14,423	15,000
Jet fuel do	2,353	2,665	2,684	3,000
Kerosine do	2,991	3,110	3,516	4,000
Distillate fuel oil do	14,148	15,021	14,966	15,000
Residual fuel oil do	25,149	27,244	29,500	30,000
Other do	3,118	2,959	2,542	3,000
Refinery fuel and losses do	3,314	3,639	4,195	5,000
Total do	66,454	69,872	71,826	75,000

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities listed, the Philippines produces platinum-group metals as byproducts of other metals, but output is not reported quantitatively and no basis is available to make reliable estimates of output levels.

[2] Reported figure.

[3] Includes unspecified earths.

TRADE[6]

Total trade in 1979 was $10.7 billion compared with $8.1 billion in 1978. Exports increased 35%, reaching $4.6 billion in 1979. The Philippines is well known for its exports of forestry and agricultural products. Shipments of coconut oil during the year were valued at $740 million; followed by logs and lumber, $341 million; and sugar,

$212 million. For mineral commodities, the value of exports of copper concentrates totaled $440 million; followed by gold, $103 million; chromite, $22 million; and cement, $13 million.

The value of imports increased from $4.6 billion in 1978 to $6.1 billion in 1979. Receipts of mineral fuels and related materials alone totaled $1.4 billion in 1979. Imports of base metals were $532 million; metal manufactures, $128 million; and nonmetallic manufactures, $47 million. Imports of chemical products and fertilizers in 1979 were $441 million and $88 million, respectively.

Table 2.—Philippines: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS			
Aluminum metal including alloys, all forms	1,795	843	Japan 366; Indonesia 238; Hong Kong 134.
Chromium: Chromite ore and concentrate	378,104	432,937	United States 159,319; Japan 74,616; Sweden 67,049; United Kingdom and northern Ireland 53,125.
Copper:			
Ore and concentrate	956,558	1,011,105	Japan 749,244.
Metal including alloys:			
Scrap	1,305	930	Taiwan 586; Japan 246.
Matte	8	2	All to Belgium-Luxembourg.
Unwrought and semimanufactures	--	36	All to Taiwan.
Gold:			
Bullion thousand troy ounces	140	94	All to United Kingdom and northern Ireland.
Metal, rolled, unworked or partly worked do	395	419	Japan 283; United States 68.
Iron and steel:			
Ore and concentrate thousand tons	836	1,983	All to Japan.
Roasted pyrite do	34	56	Taiwan 42; Japan 11.
Metal:			
Scrap	80	369	Hong Kong 220; Japan 149.
Pig iron, ferroalloys, similar materials	7,304	4,778	Japan 2,229; Thailand 1,646; Malaysia 540.
Semimanufactures:			
Bars, rods, angles, shapes, sections	1	--	
Universals, plates, sheets	r18,407	16,805	United States 14,809; Belgium-Luxembourg 1,996.
Wire	--	23	Guam 16; Thailand 7.
Tubes, pipes, fittings	16	59	Australia 31; Guam 13; Pacific Islands 11.
Castings and forgings	70	477	United States 289; Australia 132; Thailand 55.
Lead, ore and concentrate	7,395	6,555	All to Japan.
Magnesium metal including alloys, all forms	4	--	
Manganese ore and concentrate	6,800	10,660	Japan 6,450; Taiwan 4,210.
Molybdenum ore and concentrate	--	11	All to United States.
Nickel:			
Ore and concentrate	--	488,597	All to Japan.
Metal including alloys, all forms	12,110	17,252	United States 11,851; Netherlands 5,615.
Silver metal including alloys, unworked and partly worked:			
Silver, including silver gilt and platinum-plated silver thousand troy ounces	88	9	All to United Kingdom and northern Ireland.
Rolled do	71	--	
Zinc:			
Ore and concentrate	17,490	24,234	Japan 23,524.
Metal including alloys:			
Scrap	36	--	
Unwrought and semimanufactures	1	--	
Other:			
Ash and residue containing nonferrous metals	r4,852	11,398	Sweden 9,500; Taiwan 1,427.
Base metals including alloys, all forms	r1,650	3,420	All to Taiwan.
NONMETALS			
Barite	1,170	--	
Cement	662,055	884,202	Indonesia 178,059; Hong Kong 174,196; Saudi Arabia 144,301; Bangladesh 74,562; Iran 74,500.
Chalk	--	1	All to Hong Kong.
Clays and clay products (including all refractory brick):			
Crude	--	(1)	All to Indonesia.
Products, nonrefractory value, thousands	$4,999	$5,566	United States $2,942; Singapore $851.
Diamond, industrial carats	--	7	All to United Kingdom and northern Ireland.

See footnotes at end of table.

Table 2.—Philippines: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
NONMETALS —Continued			
Fertilizer materials:			
Manufactured, mixed	[r]14	6	Pacific Island 5; Hong Kong 1.
Ammonia	--	2	All to Hong Kong.
Lime	10	--	
Pigments, mineral: Iron oxides, processed	2,600	--	
Pyrite	58,530	35,867	Japan 35,014.
Salt	(1)	4	Brunei 2; Canada 1.
Sodium and potassium compounds: Caustic potash	--	1	All to Australia.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	695	304	Mainly to Taiwan.
Other	598	--	
Worked:			
Marble	[r]124	1,170	Japan 825.
Other	--	1	All to Guam.
Gravel and crushed stone	1	147	Hong Kong 126; Singapore 20.
Quartz and quartzite	2,875	2,400	All to Japan.
Sand:			
Natural (river and sea)	13,993	581	United States 125; United Kingdom 114; Hong Kong 95; Netherlands 74; Italy 60.
Silica	--	100	All to Japan.
Sulfuric acid	22	106	All to Guam.
Other:			
Crude	566	28,409	Australia 27,516.
Slag, dross, and similar waste, not metal bearing	--	30	All to Taiwan.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	7	All to Hong Kong.
Carbon black	845	1,179	Taiwan 792; Thailand 248; Malaysia 105.
Petroleum refinery products:			
Gasoline, motor thousand 42-gallon barrels	693	607	Pacific Islands 250; Guam 115; New Caledonia 88; Fiji 69.
Kerosine and jet fuel do	69	60	All to Pacific Islands.
Distillate fuel oil do	182	188	Do.
Lubricants do	151	60	Singapore 56.
Other:			
Liquefied petroleum gas do	--	(1)	All to Pacific Islands.
Mineral jelly and wax do	(1)	--	
Asphalt do	[r]5	--	
Unspecified do	(1)	(1)	All to Australia.
Total do	[r]1,100	915	

[r] Revised.
(1) Less than 1/2 unit.

Table 3.—Philippines: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS			
Aluminum:			
Bauxite ore and concentrate	4,362	7,750	India 3,030; Malaysia 2,719; United States 2,000.
Alumina	1,926	2,576	Japan 1,658; United States 494; Taiwan 311.
Metal including alloys:			
Scrap	19	61	United States 46; Japan 15.
Unwrought	17,379	16,992	United States 6,402; Australia 5,877; Japan 3,068.
Semimanufactures	[r]2,290	3,618	Japan 2,167; France 622; United States 314.
Arsenic trioxide, pentoxide, acids	106	135	Mainly from France.
Chromium oxide and hydroxide	129	202	West Germany 118; United States 65.
Cobalt oxide and hydroxide	4	9	Belgium-Luxembourg 3; Netherlands 3; United States 2.
Copper:			
Copper sulfate	97	234	France 109; West Germany 58; United Kingdom 51.

See footnotes at end of table.

Table 3.—Philippines: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS —Continued			
Metal including alloys:			
Scrap	--	11	All from Japan.
Unwrought	^{r}6,167	6,442	Japan 4,124; Canada 1,295; Australia 58.
Semimanufactures	^{r}3,151	3,982	Japan 2,647; Australia 548; United States 397.
Iron and steel:			
Ore and concentrate	--	2,406,905	Australia 1,212,617; Brazil 739,871; Canada 411,683.
Metal:			
Scrap	^{r}106,144	62,234	Australia 58,760.
Pig iron, cast iron, powder, shot	^{r}63,309	53,001	India 39,634; Australia 9,457.
Ferroalloys	2,001	2,893	Japan 1,254; Taiwan 1,105.
Steel, primary forms	^{r}862,278	650,602	Japan 279,520; Australia 275,529; India 82,540.
Semimanufactures:			
Bars, rods, angles, shapes, sections	^{r}66,538	72,206	Japan 50,024; Australia 8,745; United States 8,114.
Universals, plates, sheets	^{r}333,908	208,047	Japan 158,946; Australia 30,069.
Hoop and strip	10,940	29,697	Australia 22,948; Japan 5,988.
Rails and accessories	2,283	10,717	United States 8,326; Japan 1,929.
Wire	14,439	12,713	Japan 10,698.
Tubes, pipes, fittings	^{r}24,948	27,828	Japan 23,192; United States 3,180.
Castings and forgings, rough	18	143	United States 102; Japan 41.
Lead:			
Oxides	^{r}187	86	Australia 60; United States 25.
Metal including alloys, all forms	^{r}5,190	6,911	Australia 3,983; Canada 1,188.
Magnesium metal including alloys, all forms	^{r}20	10	Norway 5; Sweden 5.
Manganese:			
Ore and concentrate	3,216	9,501	Australia 3,849; Ghana 2,792; United States 2,401.
Oxides	1,056	1,924	Japan 759; United Kingdom 594; Ireland 343.
Mercury 76-pound flasks	869	1,027	Japan 476; United States 295; China, mainland 100.
Molybdenum:			
Ore and concentrate	^{r}1	48	All from Canada.
Metal including alloys, all forms	(1)	169	United Kingdom 40; United States 33; Canada 32; Netherlands 25; Sweden 28; West Germany 19.
Nickel metal including alloys, all forms	^{r}162	182	Japan 81; Austria 23; Australia 19.
Platinum-group metals, unwrought and semimanufactures troy ounces	19	311,707	Mainly from United States.
Silver:			
Silver leaf and silver foil do	226	825	West Germany 643; United States 165.
Silver, including silver gilt and platinum-plated silver, unwrought and semimanufactures do	1,190	43,350	Japan 21,319; West Germany 17,656; United States 4,375.
Tin:			
Oxides	5	(2)	Mainly from Japan and Australia.
Metal including alloys, all forms	^{r}293	709	Malaysia 578.
Titanium:			
Rutile ore and concentrate	539	252	Mainly from Australia.
Oxide and hydroxide	2,625	2,049	Australia 520; West Germany 490; Japan 426; United Kingdom 318.
Tungsten metal including alloys, all forms	^{r}2	1	Mainly from Australia.
Zinc:			
Oxide and peroxide	494	699	Taiwan 309; Australia 188.
Metal including alloys, unwrought and semimanufactures	^{r}14,165	18,761	Japan 9,218; Australia 4,835; Canada 1,546.
Zirconium ore and concentrate	--	67	Japan 34; Australia 33.
Other:			
Ores and concentrates of base metals	74	102	Mainly from Australia.
Oxides, hydroxides, peroxides of metals	136	368	Republic of Korea 147; Japan 91; United States 48.
Metalloids	7	NA	
Nonferrous base metals including alloys, all forms	^{r}21	60	China, mainland 20; Hong Kong 8; United States 8; Singapore 7; Japan 4.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	257	918	India 293; United States 267; Greece 180; Spain 91.

See footnotes at end of table.

Table 3.—Philippines: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
NONMETALS —Continued			
Abrasives, natural, n.e.s. —Continued			
Dust and powder of precious and semiprecious stones kilograms	4	1,500	Mainly from Japan.
Grinding and polishing wheels and stones	1,063	845	China, mainland 302; West Germany 163; Japan 139.
Asbestos	2,471	4,286	Canada 2,304; Australia 810; United States 691.
Barite and witherite	272	632	Singapore 408; Australia 74.
Boron materials, oxide and acid	594	582	United States 496.
Cement	8,731	16,851	Japan 15,200.
Chalk	640	--	
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite and fuller's earth	1,584	1,082	United States 556; Singapore 272; Japan 152; China, mainland 100.
Fire clay	1,397	2,332	United States 1,721; Japan 378.
China clay	5,226	7,168	United States 2,197; Malaysia 1,546; United Kingdom 1,451; Japan 1,156; Republic of Korea 800.
Other	^{r}9,827	10,343	United States 7,816; Japan 1,823.
Products:			
Refractory (including nonclay brick) value, thousands	$6,055	$7,311	Japan $2,055; United Kingdom $1,763; United States $1,081; Austria $958.
Nonrefractory do	^{r}$468	$259	Japan $109; Italy $83; Republic of Korea $51.
Cryolite and chiolite	2	2	All from Japan.
Diamond, industrial carats	54,905	73,300	Congo 46,000; Australia 21,000.
Diatomite and other infusorial earth	^{r}1,446	2,255	United States 1,759; Japan 481.
Feldspar and fluorspar	3,695	2,968	India 804; Italy 448; Japan 348; Republic of Korea 295.
Fertilizer materials:			
Crude:			
Nitrogenous	16	--	
Phosphatic	60,776	79,919	United States 74,146.
Manufactured:			
Nitrogenous	^{r}65,463	77,521	Republic of Korea 41,914; Japan 35,162.
Phosphatic	25,839	2	All from United States.
Potassic	73,419	69,842	Canada 31,117; U.S.S.R. 16,147; United States 9,964; West Germany 7,363.
Other, including mixed	1,196	1,010	West Germany 803; Japan 153.
Ammonia	271,160	127,872	Mainly from Japan.
Graphite, natural	^{r}113	182	Republic of Korea 68; Sri Lanka 40; Austria 34; United States 17.
Gypsum and plasters:			
Gypsum	64,328	81,462	Mainly from Japan.
Plasters	5,449	4,631	West Germany 4,047.
Lime	415	270	Japan 162; United States 55; United Kingdom 53.
Magnesite	1,378	1,037	Japan 552; Austria 203; China, mainland 200.
Mica:			
Crude, including splittings and waste	38	133	India 80; United States 19; Switzerland 17.
Worked, including agglomerated splittings	14	16	Japan 6; India 5; West Germany 4; Hong Kong 1.
Pigments, mineral:			
Natural, crude	2,392	2,905	United Kingdom 1,528; India 1,190.
Iron oxides, processed	1,596	1,139	West Germany 787; Spain 206.
Pyrite	--	1	All from United States.
Salt	55,151	61,599	Australia 59,296.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	28,751	23,005	United States 7,805; Switzerland 7,000; Italy 3,001.
Caustic potash	25,055	384	United States 186; Spain 102; Japan 63.
Sodium carbonate	^{r}67,612	60,976	United States 29,596; Japan 9,491; Netherlands 6,500; Kenya 6,450.
Stone, sand and gravel:			
Dimension stone, crude and worked	1,064	779	China, mainland 309, Taiwan 299; Hong Kong 168.
Dolomite	8,885	7,717	Japan 5,427; Taiwan 1,090.
Gravel and crushed stone	88	384	France 220; Japan 149.
Limestone (except dimension)	^{r}521	1,213	Japan 972; Taiwan 100.

See footnotes at end of table.

Table 3.—Philippines: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
NONMETALS —Continued			
Stone, sand and gravel —Continued			
Quartz and quartzite	175	144	United States 47; Sweden 34; Japan 17; Netherlands 16; Spain 15.
Stone for industrial uses (including soapstone), n.e.s	^{r}189	--	
Sand:			
Natural (river and sea)	--	18	All from Japan.
Silica	6,227	7,572	Mainly from Australia.
Other	180	547	Australia 284; United States 180; Taiwan 45.
Sulfur:			
Elemental, all forms	18,944	12,461	Canada 8,790; Japan 2,500.
Sulfur dioxide	2	18	West Germany 10; Canada 5; United States 2; Japan 1.
Sulfuric acid	42,237	52,762	Mainly from Japan.
Talc	^{r}6,671	7,756	Republic of Korea 5,647; United States 777.
Other:			
Crude	1,252	476	Australia 290; Singapore 100; Japan 47.
Slag, dross, and similar waste, not metal bearing	3,817	6,062	Mainly from Japan.
Oxides, hydroxides, and peroxides of magnesium, strontium, barium	789	844	Australia 324; Japan 223; United States 144; United Kingdom 107.
Bromine, iodine, fluorine	4	2	Japan 1.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,598	929	Republic of Korea 900.
Carbon black	947	1,007	United States 460; Japan 459.
Coal and coke and briquets thereof	21,320	188,283	Japan 72,846; Australia 47,566; United States 25,771; Argentina 18,929.
Hydrogen and other rare gases	^{r}132	114	Japan 75; Netherlands 18.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	70,256	70,116	Saudi Arabia 25,363; Kuwait 11,141; Indonesia 10,490; Iraq 9,409.
Refinery products:			
Gasoline, aviation do	125	118	Iran 72; Taiwan 46.
Distillate fuel oil do	5,979	8,225	Bahrain 4,906; Iran 2,178; Saudi Arabia 852.
Lubricants do	^{r}301	175	United States 102; Singapore 46.
Other:			
Liquefied petroleum gas do	286	452	Republic of Korea 281; Singapore 91; Australia 61.
Naphtha do	1,229	1,720	Bahrain 726; Saudi Arabia 556; Singapore 437.
Mineral jelly and wax do	90	90	Indonesia 33; China, mainland 27; United States 12; Japan 9.
Unspecified do	^{r}11	13	United Kingdom 6; Singapore 2; United States 2.
Total do	8,021	10,798	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,649	41,768	Singapore 18,610; Saudi Arabia 10,547; Bahrain 9,448.

^{r}Revised. NA Not available.

[1] Revised to none.

[2] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—The Government of the Philippines was negotiating a joint venture agreement with Reynolds Aluminum Co. for a 50-50 equity in the construction of a $450 million aluminum smelter in Claveria, Misamis Oriental, Northern Mindanao. The proposed plant, to be operational in 1985, would have an initial installed capacity of 70,000 tons per year of metal, to be expanded later to 140,000 tons. Site selection was based on dependable hydroelectric power, good roads, and shipping facilities in the Phividec area. A separate agreement was to be negotiated for the power requirements to be supplied by the hydroelectric projects from the Polangui and Agus Rivers.

Exploration by the Bureau of Mines has delineated bauxite reserves in the Samar area between 65 and 100 million tons. Detailed geologic work was being conducted at Samar as well as research by the Bureau of Mines and Reynolds to extract and upgrade the bauxite, containing 40% to 50% Al_2O_3. The Leyte-Samar area has abundant geothermal energy available if alumina facilities were to be constructed there.

Chromium.—There were five producers of refractory-grade chromite in the Philippines. Consolidated Mines, Inc., accounts for 97% of the total output, followed by Pulsar Mineral Resources, Inc., 2%; and three companies for the remainder. Output of metallurgical-grade chromite was by 22 companies. Inter-Continent Mineral & Oil Corp. produces around 5,000 tons per year; G. Lluch & Sons, Inc., 3,100 tons; six companies produce 2,000 to 2,999 tons; nine companies 1,000 to 1,999 tons; and five produce less than 1,000 tons. Production of concentrates of metallurgical-grade chromite was by three companies: Acoje Mining Company, Inc., accounts for 63% of the total; Trident Mining & Industrial Corp., 25%; and the Golden Arrow Mining Co., Inc., 12%. Shipments to Japan account for about 40% of all exports, followed by the United States, 30%; Mainland China, 7; and Brazil, 5; the bulk of the remainder goes to Australia, Canada, and the Netherlands.

The Philippines ranks in the top 10 producers of chromite in the world. Reserves of chromite, estimated by the Philippine Bureau of Mines, were 13,970,000 tons distributed as follows: Metallurgical grade (12% to 52% Cr_2O_3), 6.36 million tons; and refractory grade (29% to 38% Cr_2O_3), 7.61 million tons.

Bayer A.G. of West Germany was granted pioneer status by the Board of Investments for the construction of a P87.5 million chromite processing facility on Samar Island. By obtaining pioneer status, the company was eligible for Government incentives such as tax-free capital imports, tax deferments, and high priority for financial and nonfinancial resources. The 100,000-ton-per-year plant, to be operated by Bayer's wholly owned subsidiary, Alamag Corp., will be operational by 1983.

In 1979, Acoje Mining Co. completed a $7.2 million expansion program, boosting mining and milling capacities 50%. Meanwhile, the Heidis Group and Voest Alpine A. G. of Austria completed the takeover of the ownership and management of Acoje Mining. Ferrochrome Philippines, Inc., a joint venture of Heidis and Voest, was formed to establish a $75 million ferrochrome plant at the Phividec industrial estate in Misamis Oriental. Construction startup for the 50,000-ton-per-year ferrochrome plant was planned in early 1980 and initial production by mid-1982. All of the smelter's output is to be exported, with 25% designated for the Voest Alpine group's metallurgical operations.

Cobalt.—The sole producer of cobalt in the Philippines was Marinduque Mining and Industrial Corp. Cobalt, a byproduct of nickel mining, is currently recovered in the Philippines as a mixed nickel-cobalt sulfide which is shipped to Japan for processing by Sumitomo. The National Economic and Development Authority disapproved Marinduque's proposal to construct a cobalt refining plant. The average annual cobalt recovery was about 1,200-ton-per-year.

Copper.—Twelve producers account for virtually all of the mine copper output in the Philippines. Atlas Consolidated Mining & Development Corp., the largest, accounts for 42% of total production; followed by Marcopper Mining Corp., 15%; Marinduque Mining & Industrial Corp., 10%; Philex Mining Corp., 8%; CDCP Mining Corp., 7%; Lepanto Consolidated Mining Co., 6%; Western Minolco Corp., 4%; and the bulk of the remainder by Consolidated Mines, Sabena, Baguio Gold, Black Mountain, and Acoje, in that order. In addition, copper recovered as a byproduct of zinc mining totaled around 543 tons (less than 0.1% of the national output) and was by Zambales Base Metals, Inc., and Benguet Exploration, Inc.

Atlas Consolidated, a subsidiary of A. Soriano Corp., operates one underground mine and three open pit mines in Cebu. In 1979, Atlas installed three diesel generating units with a combined capacity of 34 megawatts to insure power adequate to run its mines and mills. A sixth ball mill circuit was added at Carmen and new fines crushing equipment at the concentrator. Ore reserves held by Atlas in Cebu totaled 937 million tons, averaging 0.46% copper. Atlas is the largest producer of silver in the Philippines and recovers gold as well as molybdenum sulfide concentrates from its operations.

Marcopper Mining Corp.'s primary open pit mine and mill is in Tapian, Marinduque Island. Marcopper's ore reserve base totals

68.1 million tons of 0.58% copper. Development continued on the San Antonio mineralized zone, 4 kilometers north of the Tapian pit; ore production could begin in 1981. Marcopper is also the fifth largest gold producer and the third largest silver producer in the Philippines.

Marinduque Mining and Industrial Corp. operates the Sipalay and Bagacay Mines under a 25-year lease from the Government; the lease is renewable for an additional 25 years. Marinduque was planning an expansion of the Sipalay capacity from 18,000 tons per day to 30,000 tons per day. The company is the only nickel producer and the fourth largest silver producer in the Philippines and in also a producer of gold and molybdenum.

Four new copper mining projects were onstream at the end of 1979. Sabena Mining Co. has a production capacity of 10,000 tons per day (tpd) at its Kamanlangan project in Maco, Davao del Norte. CDCP Mining Co.'s project in Basay, Negros Oriental has a production capacity of 10,000 tpd. Sabena and CDCP were newly organized copper producing firms. Consolidated Mines began operating its 15,000-ton-per-day Ino project in Mogpog, Marinduque; and Benguet Consolidated's 17,000-ton-per-day Dizon project in San Marcelino, Zambales.

By the submission deadline of 5:00 p.m., August 15, 1979, Philippine Associated Smelting and Refinery Corporation (PASAR) received three bids for the construction on a turn-key basis of the country's first copper smelter and refinery. PASAR is composed of 11 Philippine copper firms and the Government of the Philippines. The bidding companies were Canada's SNC Ltd.; the Anglo-Finnish consortium of Davy McKee International, Selection Trust, and Outokumpo Oy; and Japan's Marubeni Corporation. The smelter-refinery contract was awarded to Marubeni, and the formal ratification was scheduled for January 14, 1980, in Tokyo. Construction cost for the copper facility, to be sited in Southern Leyte, was $250 million, including provisions for contingencies and cost escalation.

Gold.—Production of gold was by 7 primary producers and 11 secondary (byproduct) producers. Primary gold production accounts for about 25% of the total output; the other 75% is byproduct recovery from other metal mining activity. Production by the top five producers in 1979 was as follows in kilograms (figures in parentheses are 1978 output); Philex, 3,914 (5,085); Atlas, 2,996 (3,379); Benguet Consolidated, 2,703 (3,331); Lepanto, 2,368 (2,265); and Marcopper, 1,617 (2,283). Production by each of the remaining producers was less than 700 kilograms in 1978 and 1979.

Reserves of gold ore were estimated by the Philippine Bureau of Mines at 802 million tons assaying from 0.11 to 20.57 grams of gold per ton. Also there are 24 known, undeveloped gold prospects totaling around 200 million tons. Total rated ore capacity is 2.03 million tons per year. Higher prices for gold, offset the declining ore grade and high cost of production cited by producers. Production costs for primary producers were estimated to be between $4.82 and $5.78 per gram, or $150 to $180 per ounce. Gold production in the Philippines was expected to increase at an average rate of 9% per year during 1979-82.

The gold and silver refinery and mint in Quezon City of the Central Bank of the Philippines was commissioned in January 1978. The P222 million complex will print the country's currency and mint coins, and was to refine the national output of gold and silver. Designed capacity for the refinery was 600,000 troy ounces of gold (0.990 to 0.995 fineness) per year and 400,000 troy ounces of silver (to 0.999 purity) per year. However, initial installed capacity was 300,000 ounces for gold and 200,000 ounces of silver.

Gold refining by the Central Bank (CB) was mandatory, and all gold produced was to be sold to the CB. Secondary gold producers informed the CB that copper concentrates, including the precious metal values, were covered by existing smelting contracts with foreign companies. The Monetary Board then temporarily waived the requirement that gold output of secondary producers be sold to the CB at current market prices.

Iron and Steel.—Production of iron sands from beach mining operations was banned in 1976. About 100,000 tons of pyrite cinder have been produced annually from copper operations in Bataan, Buluccan, Cebu, Pangasinan, and western Samar. The status of developing the magnetite deposit in northern Lugon was unknown. Kawasaki Steel Corp. operates its 5-million-ton-per-year-capacity iron ore sintering plant in Villanueva using imported ore from Australia, Brazil, and Canada, and domestically mined limestone. Total output of the plant is shipped to Kawasaki facilities in Japan.

The establishment of an iron and steel industry, first proposed in 1965, was announced as one of the 11 industrial projects included in the major economic policy for the 1980's. The proposed integrated mill was to be built on 700 hectares of the 3,000-hectare Phividee Industrial estate in Tagaloan at a cost of $1.44 billion. Feasibility studies for the 1.5-million-ton-per-year mill were being conducted.

In early 1978, Armco-Marsteel Alloy Corp. placed into operation its steelworks in Taguig. Plant capability includes production of some 50 grades of carbon and alloy steel for forging, machinery, structural, and other high-strength applications. National Steel Corp. has two plants for production of steel products using mainly imported materials; Elizalde Iron and Steel Co. operates a cold mill and a tinplate plant; and other producers such as Philippine Blooming Mills' Mindanao Steel have remelt and fabrication facilities.

The Government announced plans for a charcoal-fired 100,000-ton-per-year pig iron plant in Currimao, Ilocos Norte. Raw material feed for the plant included iron ore to be mined in Ilocos Norte, limestone from Bacnotan Cement Co. and Northern Cement Co., and charcoal from a 10,000-hectare plantation being created by the Bureau of Forest Development near the site.

Lead-Zinc.—Production of lead-zinc in the Philippines is virtually by two primary producers. Benguet Exploration, Inc., better known for gold and silver, produced zinc from its mine in the Baguio area, Benguet, Ilocos region; and Zambales Base Metal, Inc., produced lead and zinc at its operation in Zamboanga del Sur, western Mindanao. Zambales' output is shipped to Japan, while Benguet Exploration exports to the United States.

Molybdenum.—Production of molybdenum sulfide concentrate was wholly by Marinduque Mining from its Sipalay Mine and by Atlas Consolidated from its Carmen project. Both companies recover molybdenum as a byproduct of copper mining. Exports of concentrate in 1978 were to the United States and the Federal Republic of Germany.

Nickel.—During 1978-79, nickel ore was produced by Marinduque Mining, Rio Tuba Nickel Mining Corp., and Infanta Minerals and Industrial Corp. The nickel industry is considered a priority investment by the Philippine Government which grants such incentives as tax—free imports of capital equipment, deductions for organizational and operational expenses, and accelerated depreciation schedules. Marinduque Mining, the largest producer in the Philippines, also operates the Surigao Nickel Refinery and recovers cobalt in the form of mixed nickel-cobalt sulfides. Marinduque Mining's ore reserves were estimated at 125 million tons of 1.22% nickel, 0.12% cobalt, and 38.5% iron. Marinduque Mining suffered from operational difficulties both at the mine and at the refinery. Despite a decrease in production, output value rose 30% because of higher nickel prices. The company's operations further benefited from its cobalt recovery; a tight supply worldwide resulted in a higher price for the metal.

Rio Tuba operates its mine on Palawan Island which has a rated annual production capacity of 700,000 tons, containing 11,000 tons nickel. Mine output is shipped to ferronickel smelters in Japan for processing. Rio Tuba's ore reserves were estimated at 13 million tons. Plans for installing a refining complex were deferred in 1978 because of the soft market. The remainder of the nickel production in 1978-79 was by Infanta Minerals. Acoje Mining's nickel mine was not operated during both years. New Frontier Mines, Inc., was expected to proceed with its plans for the $25 million Isabela project, which was designed to produce 6,800 tons per year of ferronickel.

Uranium.—Presidential Decree No. 1101 outlined the guidelines and incentives for the opening, processing, and refining of radioactive materials, thereby encouraging the private sector to explore and develop uranium resources. Ultrana Nuclear & Minerals Corp. and Western Nuclear Co. were to conduct uranium exploration jointly in the Mabinay area in Negros Oriental. At least $250,000 will be spent for exploration and an additional $750,000 if test results are favorable. The Philippine Bureau of Mines in cooperation with the Philippine Atomic Energy Commission was to undertake exploration activities in Larap, Jose Panganiban (Camarines Norte). Other possible exploration activities were for possible uranium occurrences in Hinabangan, Samar; Salsona, Ilocos Norte; Ayala district, Zamboanga; and Magna Rosa, Caranoan Peninsula.

NONMETALS

Cement.—Reconstruction and development of the cement industry is one of the 11 projects established under the economic policy for the 1980's. Owing to mounting domestic demand, the Government projected a deficit in the supply of cement by 1981-82. Presently there are 17 cement-producing companies in the Philippines with a rated capacity of 7.4 million tons annually. Rated capacity, however, has not been attained because of electricity supply shortfall, adverse weather, and generally widespread operating problems.

The Development Bank of the Philippines (DBP) was making available P1 billion for the rehabilitation and expansion of existing cement plants. The funds also included a coal conversion program for the industry. The DBP will select the cement firms to be included in the rehabilitation program based on the findings of a rating team studying the industry.

Local limestone is abundant, as is byproduct gypsum. The six top producing companies were Northern Cement Co., Republic Cement Co., Floro Cement Co., Island Cement Corp., Philipinas Cement Corp., and Fortune Cement Corp., in that order. These companies account for about 55% of the total annual cement production.

Other Nonmetals.—The Philippines produces about 0.5 million tons of various clays and about 15 million cubic meters of aggregates for construction materials. Close to 10 million tons of limestone is produced annually for use in cement manufacture and for industrial and agricultural uses. Output of other fertilizer materials includes phosphate rock, pyrite, and guano. Other nonmetallics produced include alumina and silica sands, silica quartz, diorite, dacite, and salt. In addition, small quantities of andesite, barite, feldspar, talc, and miscellaneous materials are produced.

The Government was studying the feasibility of establishing a $340 million chemical fertilizer facility with or without Association of South East Asian Nations (ASEAN) participation. The project would utilize 300,000 tons of byproduct sulfuric acid from the proposed copper smelter and also will have a capacity of 350,000 tons per year of phosphate fertilizers. If established, it was believed that $150 million would accrue to the country through export earnings. The Government was expected to discuss the possibility of a joint venture agreement with Agrico of the United States and International Minerals and Chemical Corp. of Canada.

MINERAL FUELS

Coal.—Production of coal in the Philippines is insignificant, less than 300,000 tons annually between 1973 and 1978. In an attempt to increase the national output, PD 972 (Coal Development Act of 1976) encouraged coal companies to pool resources to enhance the producers' financial and technical capabilities. PD 1174 further enhanced incentives offered by PD 972 by increasing the operator's maximum share in net proceeds by another 10% and by upgrading the cost recovery allowance to 90% of gross proceeds (originally 70%). In 1979, International Industrial Management and Development Corp. acquired the rights of the Malangas Mines from Maria Cristina Chemical Industries, Inc., to intensify coal production. Vulcan Industrial and Mining Corp., Sulu Sea Oil and Development Co., and Seafront Petroleum and Mineral Resources, Inc., formed Signal Consortium to undertake the $150 million development of the Semirara coal project. Equity in Signal will be distributed evenly among the three participants with an initial paid-up capital of P300 million (total authorized capital of P500 million). Signal was also negotiating long-term sales contracts with a mining company, a public utility, and two cement producers.

Petroleum.—Oil developments in the Philippines are offshore, northwest of Palawan. The only producing area was from the Nido complex with five wells. Pumping from the South Nido A-1 well was experiencing difficulty owing to a high percentage of water seepage due to oil being drawn. This well was expected to be shut down in early 1980 to stabilize the reservoir pressure. The other four wells in the Nido field were operating at an output of 21,300 barrels per day (production capacity of each was 40,000 barrels) at yearend 1979.

Production from the Cadlao and Matinloc fields offshore Palawan has not begun. American Oil Company (Amoco) originally planned to begin operations late in 1980. However, because of delays in equipment shipments scheduled for October (beginning of the monsoon season), Amoco deferred initial operations until early 1981. The Matinloc field was estimated to have reserves containing between 150 million and 700 million barrels of oil. The Matinloc 1 oil samples had a 43° API gravity, comparable to a premium Arabian light crude. Testing of oil from Matinloc 2 was being conducted. If test results were favorable, Citgo (Cities Services) was expected to accelerate the development of Matinloc together with the drilling of four or five additional wells.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where appropriate, values have been converted as follows: 1978, Peso 7.3658=US$1.00; 1979, Peso 7.3775=US$1.00.

[3] U.S. Department of State. Foreign Economic Trends: Philippines (80-019). March 1980, 10 pp.

[4] Asia World Publishing House, Inc. Metro Manila, Philippines. Asia Mining Annual 1979. V. 13, April 1980, 98 pp.

[5] Chamber of Mines of the Philippines. (Metro Manila, Philippines). Newsletter. V. 5, No. 1, January 1980, 6 pp.

[6] National Economic and Development Authority (Manila, Philippines.) Philippine Economic Indicators. V. 8, No. 4, April 1980, 35 pp.

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The Mineral Industry of Poland

By Tatiana Karpinsky[1]

There are large reserves of coal, lignite, sulfur, copper, zinc, lead, salt, and construction materials in Poland, but the country remains deficient in crude oil, natural gas, iron ore, phosphate, nickel, manganese, tungsten, chrome, and rare earth. In 1978, the Polish mining industry produced over 540 million tons of raw materials including the principal raw building materials and over 550 million tons was extracted in 1979. In 1979, capital investment in the economy totaled 588 billion zlotys (Z),[2] a decrease of 1.5% as compared with the 1978 level. The net share of investment in the national income in 1975 amounted to 27%; in 1978, to 25%; and in 1979, to 21%.[3] In 1980 less than 18% of the national income is planned to be allocated to investment projects.

The tendency toward a faster production of consumer goods and of goods for export was maintained through 1978 and 1979, but not all targets of the plan in this regard were realized. According to Polish sources, the national income of Poland increased 2.8% in 1978[4] and about 2.6% in 1979.[5] The planned increase for 1979 was 4.9%. In 1979 industry provided 51.1% of the national income.

The economic performance in 1979 and the proposed plan for 1980 were presented by the Deputy Premier and Planning Commission Chairman. He made it quite evident that 1979 was the worst year for the Polish economy in 30 years and that prospects for the coming year, the final in the current 5-year plan period, seem even gloomier. The total value of the gross industrial production amounted to Z2,928.2 billion in 1978 and Z3,034.3 billion in 1979, compared with Z2,702.4 billion in 1977.

In 1978, the machine building and manufacturing industries contributed 28.3% to Poland's total industrial output; the fuel and power industry, 9.7%; ferrous industry, 5.6%; nonferrous industry, 3%; and nonmetallic mineral industry, 3.5%.[6] In 1978 and in 1979, planned targets were not met by the steel, copper, nitrogen fertilizers, and cement industries.

Transportation problems and energy cutbacks adversely affected some sectors of industry, particularly production of pig iron, rolled steel, copper, and cement. Winter and floods hampered railway and road transport.[7]

In 1978, employment in the mining industry accounted for 9.8% of the total labor force in the socialized industry.[8] In the first half of 1979, average employment in the socialized industry was 4,762,000 people, 11,500 fewer than in the first half of 1978.

Of the 352,700 employees in the coal industry, a total of 229,000 were working in underground mines in 1978. Employment in the iron and steel industry accounted for 173,800 workers.

In 1978 and 1979, Poland continued investing heavily in hard coal mining and developing a new hard coal basin in the Lublin and Chelm regions. Production from the Lublin Basin is scheduled to start in 1981 and by 1985 the basin is to produce 7 million tons of coal.

The country was also sinking new coking coal mines (Kaczyce, Ornontowice, and Pawlowice) in the Katowice and Rybnik basins. Development also continued on the 40-million-ton-per-year capacity surface mining operation in the Belchatow lignite region. In the current 5-year plan period (1976-80), about Z185 billion, is to be invested for the development of the coal industry, about Z34 billion above that provided for in the preceding 5-year plan.[9]

In 1978 and 1979, Poland was speeding up the development of copper mines (Rudna, Sieroszowice) and concentration plants (Glogow, Orsk). The country has started the construction of the second stage of the Katowice steel complex and was expanding the Lenin plant in Krakow, the Nowatko plant in Ostrowice, and the Bierut plant in Czestochowa. The country was also modernizing and expanding the chemical industry (Plock, Wloclawek, Pulawy, Tarnow).[10]

Major projects put into operation in 1978 included the Glogow 2 copper plant with projected capacity of 150,000 tons of refined copper per year, the rolling mill at the Katowice steel complex, additional production facilities of the plate rolling mill at the Bierut steel plant, a petrochemical plant in Plock, and seven power units and two thermal heating units at existing powerplants, having a total capacity of 1,900 megawatts.

In 1979, the following facilities were commissioned: A tower cable excavator at the Belchatow lignite mine, the section of copper rolling mill at the Cedynia foundry in Orsk, expansion of the cold rolling mill at the Lenin steel works, and a few others.[11]

Poland continued to participate in many multilateral investment projects for the production of natural gas, petroleum, asbestos, iron ore, and other products on Soviet territory. In return, the U.S.S.R. insured increased supplies of iron ore, crude oil, natural gas, and other raw materials over a period of 12 years.[12]

Among the most important Poland bilateral investment projects in 1978 and in 1979 were:

1. The sulfur ore mine at Tarnobrzeg, the copper mine at Lubin, and the Staszic coal mine in Upper Silesia, for which development credits have been given by Czechoslovakia.

2. The expansion of the Turnow I brown coal mine and the development of the new Turnow II mine, for which credit has come from the German Democratic Republic.

3. The potash salt mine in the U.S.S.R. for which the credit has come from Poland.

Government Policies and Programs.—Poland's economy is centrally planned and controlled by the Government. The final targets for the 1980 annual plan were approved by the Seym in December 1979.

The plan calls for greater supplies of consumer goods, enlargement of the economy's energy and raw material bases, strengthening of transport, decrease of investment, and further improvement in the balance of payments through a considerable intensification of exports.[13]

High priority is to be given to investments in fuel and raw materials. Outlays for the fuel and energy industry are planned to be increased 14%. The plan calls for a 3.0% to 4.2% increase in industrial production in 1980, a 1.4% to 1.8% increase in national income, and an 8.9% increase in export production.

The plan places special emphasis on increasing labor productivity, improving the organization of production processes and management in economy, economical use of financial, technical, and material resources, improvement in the quality of work, and further increasing wages and real income.

The planned mineral commodity production for 1980, in million metric tons unless otherwise specified, follows:[14]

Copper (0.425 originally planned)	0.380
Zinc	.230
Lead	.110
Crude steel	22.2
Fertilizer materials:	
Nitrogen	1.9
Phosphorus	1.1
Bituminous coal	200.0
Electrical energy billion kilowatt-hours	125.0
Cement	20.6

The coming eighth party congress will outline an action program for the 1981-85 5-year plan.

As for the foreign trade, the 1980 plan envisages balancing the trade with the market economy countries. In the 1980's, particular attention is to be paid to trade with socialist countries and especially to strengthening Poland's position on the Soviet market.

On February 27, 1979, the Presidium of the Polish Academy of Sciences established a Committee for Mineral Raw Material Economy as a part of its Geological and Mining Science Department in Krakow. The decision to establish the Committee stemmed from the need for more efficient mineral raw materials management, a problem of top priority in Poland.[15]

The first nuclear power station in Poland is planned to go into operation in 1984.

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PRODUCTION

Upper Silesian coal mining continued to expand in 1978 and in 1979.[16] Despite difficulties in the first quarter of 1979 (because of unfavorable weather), the hard coal mining industry recorded production growth. The Rybnic coal area, to the south of Katowice, which is to increase its output capacity by 100% in 1980-90, continued to be the center of intense development.

Development of the rich copper deposits in the Legnica Glogow region, with loans from market economy countries' banks, continued in 1978 and in 1979. Production of copper in 1978 and 1979 was below the planned targets owing to a delay in production at the Glogow 2 smelting and refining plants.

Some production increases were reported in refined lead for 1978 and 1979, but zinc production decreased for the same time.

Crude steel production in 1979 was approximately the same as in 1978, and the planned target was not met.

Production of pig iron and rolled products was also lower than planned. Crude oil production in 1978 and 1979 could not meet national demand, which required additional crude oil imports from the U.S.S.R.

Table 1.—Poland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum metal, primary	103,000	104,000	100,000	100,500
Cadmium metal, primary	[r] [e]750	754	761	766
Copper:				
Mine output, metal content, recoverable	287,000	289,300	321,000	325,000
Metal:				
Smelter, including secondary	281,200	311,000	337,000	341,000
Refined, including secondary	270,100	306,600	332,200	[2]335,800
Iron and steel:				
Iron ore and concentrate, gross weight thousand tons	674	659	529	500
Pig iron do	7,912	9,516	9,651	9,700
Ferroalloys:				
Blast furnace do	124	134	126	130
Electric furnace do	164	174	169	165
Steel:				
Crude do	15,639	17,841	19,251	[2]19,224
Semimanufactures:				
Rolled, excluding pipe do	11,501	11,950	13,566	[2]13,577
Pipe do	1,135	1,183	1,164	[2]1,161
Lead:				
Mine output, metal content, recoverable	[r] [e]60,000	63,000	63,900	65,000
Metal, refined, including secondary	80,600	85,400	86,700	87,500
Nickel:[e]				
Mine output, metal content, recoverable	2,800	2,800	2,800	2,800
Metal, smelter	2,800	2,800	2,800	2,800
Silver, mine output, metal content, recoverable[e] troy ounces	[r]17,800	10,708	21,900	23,000
Zinc:				
Mine output, metal content	[e]180,000	188,000	194,000	190,000
Metal, refined, including secondary	237,000	228,000	222,000	217,000
NONMETALS				
Barite	80,342	88,700	90,300	90,500
Cement, hydraulic thousand tons	19,800	21,300	21,700	[2]19,176
Clays and clay products:				
Crude:				
Bentonite[e] do	50	50	50	50
Fire clay do	1,261	1,352	1,292	1,300
Kaolin do	95	91	66	70
Products do	794	785	768	780
Feldspar[e] do	30	40	40	40
Gypsum and anhydrite, crude[e] [3] do	1,250	1,340	1,350	1,360
Lime, hydrated, and quicklime do	8,117	8,638	9,135	9,600
Magnesite, crude	[r]26,300	25,400	[e]24,400	25,000
Nitrogen: N content of ammonia thousand tons	1,726	1,665	1,610	1,630
Salt:				
Rock do	1,652	1,562	1,435	1,500
Other do	2,166	2,795	2,958	3,000
Sodium and potassium compounds, n.e.s.:				
Sodium carbonate (soda ash) thousand tons	726	671	663	660
Caustic soda do	388	450	489	[2]454

See footnotes at end of table.

Table 1.—Poland: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Stone:				
Dolomite thousand tons	2,393	2,685	3,118	NA
Limestone do.	7,300	NA	NA	NA
Quartzite do.	265	261	NA	NA
Other do.	16,319	17,254	17,476	[illegible]
Sulfur:				
Native:				
Frasch[e] do.	4,341	4,321	4,546	[illegible]
Other than Frasch[e] do.	550	450	505	[illegible]
Total do.	4,891	4,771	5,051	[illegible]
Byproduct:[e]				
From metallurgy do.	[r]239	314	315	[illegible]
From petroleum do.	25	35	35	[illegible]
Total do.	[r]264	349	350	[illegible]
From gypsum[e] do.	55	30	20	[illegible]
Total sulfur do.	5,210	5,150	5,421	[illegible]
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Bituminous do.	179,302	186,200	192,622	[illegible]
Lignite and brown do.	39,309	40,800	41,005	[illegible]
Total do.	218,611	227,000	233,627	[illegible]
Coke:				
Coke oven do.	17,868	19,055	20,356	[illegible]
Gashouse do.	932	845	950	[illegible]
Total do.	18,800	20,000	21,306	[illegible]
Fuel briquets, all grades do.	1,673	1,697	1,752	[illegible]
Gas:				
Manufactured:				
Town gas million cubic feet	18,964	10,736	[e]20,000	[illegible]
Coke oven gas do.	247,590	254,024	[e]261,000	[illegible]
Natural, marketed do.	236,572	253,205	282,162	[illegible]
Natural gas liquids:				
Natural gasoline thousand 42-gallon barrels	178	[e]85	[e]85	[illegible]
Propane and butane do.	58	[e]58	[e]58	[illegible]
Peat:				
Fuel	2,000	[e]2,000	[e]2,000	[illegible]
Agricultural[e]	35,000	35,000	35,000	[illegible]
Petroleum:				
Crude:				
As reported thousand tons	455	364	363	[illegible]
Converted thousand 42-gallon barrels	3,376	2,701	2,700	[illegible]
Refinery products:				
Gasoline do.	22,448	28,518	29,325	[illegible]
Kerosine (presumably including jet fuel) do.	1,132	1,194	1,240	[illegible]
Distillate fuel oil do.	36,368	38,031	39,240	[illegible]
Residual fuel oil do.	33,287	29,131	29,970	[illegible]
Lubricating oil do.	3,052	3,276	3,430	[illegible]
Grease[e] do.	100			
Paraffin do.	[r]173	189	197	--
Liquefied petroleum gas do.	[r]2,123	2,285	2,320	[illegible]
Bitumen do.	6,933	7,017	7,090	[illegible]
Total[4] do.	[r]105,616	109,641	112,812	[illegible]

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, antimony, cobalt, germanium, gold, a variety of crude nonmetallic construction materials, and carbon black are also produced, but available information is inadequate to make reliable estimates of output levels. Poland may also produce alumina in small quantities, but details of such an operation, if it exists, are not available.

[2] Reported figure.

[3] Includes building gypsum as well as an estimate for gypsum used in production of cement.

[4] Sums of listed commodities only; exclude products not reported individually as well as refinery fuel and losses.

TRADE

The turnover of foreign trade (exports plus imports) in 1978 increased 7% as compared with that of 1977. The value of exports was 44.7 billion foreign-exchange zlotys, or an increase of 9.8% and the value of imports was 50.9 billion exchange zlotys, an increase of 4.7%.

Turnover with the centrally planned economy countries increased 10%, and the share of this group of countries in the total value of turnover increased from 55.7% in 1977 to 57.4% in 1978. The turnover of Polish foreign trade with the Soviet Union increased 12.5% in 1978. The value of exports to the developed economy countries increased by 7.6%, and the value of imports remained approximately at the 1977 level.[17]

In 1978 and in 1979, the rates of trade increases were higher in the Polish trade with the centrally planned countries and with the developing countries than in trade with developed market economy countries, particularly with the countries of Western Europe. In 1978, the negative balance of trade was reduced to about $1.8 billion, and in 1980 an equilibrium of turnover is expected.

Polish trade with developed market economy countries is concentrated mainly in Western Europe, particularly the Federal Republic of Germany, the United Kingdom, France, and Italy. An important role is also played by trade with Austria, Sweden, Switzerland, and the United States.

In 1979 Poland signed export contracts with the Federal Republic of Germany, providing for sale of up to 80,000 tons of copper a year until 1990. Contracts for exports of smaller amounts of copper were also signed with Belgium, Italy, France, and the United Kingdom.

About 20 million tons of hard coal were sold to the market economy countries in 1979.

Poland maintained trade with developing countries. The greatest share in exports fell to the countries of Asia and in imports to the countries of Latin America.

Among branches of the Polish industry, the most important in external trade was machinery and equipment. The share of this group of commodities in total exports increased from 46.2% in 1977 to 46.9% in 1978.[18] Fuel and electric power contributed 15.6% to Poland's total exports; products of the ferrous and nonferrous industries, 6.4%; chemical products, 8.1%; and products of other industries, about 23%.

The import value of machinery and equipment accounted for 40.8% of the total imports, products of ferrous and nonferrous industries, 12.2%; chemical products, 11.7%; fuel and electric power, 12.9%; and products of other industries, about 22.4%.

Major commodities of Polish exports in 1978 were as follows:[19]

Commodity	Value of exports (billion zlotys)	Rate of growth in value in percent (1977=100)	Percent of total exports
Hard coal	5.50	6.2	12.3
Iron and steel products and semiproducts	1.30	12.0	2.9
Sulfur	.67	0.6	1.5
Copper and semi-products	.64	10.2	1.4
Petroleum products	.54	-23.3	1.2
Coke	.48	-16.6	1.1

Major commodities of Polish imports in 1978 were as follows:

Commodity	Value of imports (billion zlotys)	Rate of growth in value in percent (1977=100)	Percent of total imports
Crude petroleum	4.62	13.0	8.1
Iron and steel products	2.81	-11.8	5.3
Iron ore	1.05	-2.9	2.0
Petroleum products	1.05	4.0	2.0
Natural gas	.52	21.6	1.0
Pig iron	.51	-0.3	1.0
Phosphate rock	.49	-2.0	.9
Potash fertilizers	.47	-16.9	.9
Aluminum and semiproducts	.34	39.4	.6

In the first half of 1979 foreign trade turnover (in current prices) increased by 6.9% as compared with the first half of 1978. The value of exports increased by 10.2%, while the value of imports increased by 3.7%. Trade with centrally planned countries increased 11.5% for the same period, and trade with economy market countries increased 0.8%, with exports going up 2.7% and imports dropping 0.7%. This improved the trade balance with those countries.

Poland's accumulated negative trade balance amounted to about $15 billion in 1979.

Trade with the U.S.S.R. accounted for about 30% of Poland's entire foreign trade turnover and 60% of Poland's trade with Council for Mutual Economic Assistance (CMEA)[30] countries in 1979. Turnover in 1980 is to increase substantially over the turnover in 1979 so that total value of Polish-Soviet trade for the 1976-80 period will be almost 33 billion rubles ($49.5 billion at current official dollar-ruble exchange rate) and will also be 5 billion rubles (about $7.5 billion) higher than called for in the original plan. In 1979, imports from the U.S.S.R. made up 30% of all imports of machinery and equipment.

The U.S.S.R. covered 40% of Poland's demand for imported raw materials, including 76% of the crude oil, 100% of the natural gas, 75% of the iron ores, 88% of manganese ore, 60% of chromium ore, and 69% of potassium fertilizers.

An agreement on the 1980 trade exchange and payment between Poland and the Soviet Union was signed in Warsaw on January 4, 1980. It provides for a further increase in trade with machinery and equipment, accounting for 59.8% of exports to the U.S.S.R. Raw and primary materials and fuels will constitute 57.8% of the total imports from the Soviet Union. Planned 1980 imports from the U.S.S.R. included 13.1 million tons of crude oil, 600,000 tons of gasoline, 2.2 million tons of other refined petroleum products, 9 million tons of iron ore, 53,000 tons of aluminum, and 1.2 million tons of potash. Poland will continue to export sulfur, copper, coal, and zinc to the U.S.S.R.

In 1979, Poland signed a $550 million loan agreement with a group of international banks, including U.S. banking for general economic development. Previous loans were signed for specific investment projects. For the 1980's, Poland is planning a long-range program for increased exports.[31]

Table 2.—Poland: Exports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Alumina	--	[3]6	All to United Kingdom.
Metal including alloys:			
Scrap[2]	6,976	10,610	Austria 7,024; West Germany 1,897.
Unwrought	31,696	30,374	Hungary 17,500; Japan 8,053; France 3,289.
Semimanufactures	734	[3]264	Italy 123; Austria 54; West Germany 31.
Cadmium metal including alloys, all forms	--	10	All to West Germany.
Chromium oxide and hydroxide	[3]480	309	West Germany 105; Spain 55; Yugoslavia 50.
Copper:			
Sulfate	--	95	All to West Germany.
Metal including alloys:			
Scrap	1,692	260	West Germany 149; United Kingdom 73.
Unwrought[3]	117,919	146,688	West Germany 53,259; United Kingdom 43,[illegible]; Czechoslovakia 11,649.
Semimanufactures[3]	24,778	30,600	Czechoslovakia 7,803; U.S.S.R. 5,574; Romania 2,691.
Iron and steel:			
Pyrite, roasted	8,815	18,456	All to Hungary.
Metal:			
Scrap	[3]633	13,566	West Germany 9,458; Spain 2,625.[3]
Pig iron	100	--	
Ferroalloys	483	[3]11	All to Sweden.
Steel, primary forms thousand tons	[4]539	[4]706	Greece 186;[3] West Germany 168; Belgium-Luxembourg 108;[3] Yugoslavia 85.
Semimanufactures:[4]			
Bars, rods, angles, shapes, sections do	440	537	West Germany 110; Yugoslavia 30; undetermined 351.
Plates and sheets do	456	426	West Germany 66; Norway 31;[3] Yugoslavia [illegible]; Sweden 23; undetermined 172.

See footnotes at end of table.

Table 2.—Poland: Exports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Semimanufactures[4] —Continued			
Hoop and strip __ thousand tons	171	139	Yugoslavia 18; Sweden 12;[2] West Germany 10; undetermined 79.
Rails and accessories ___do	72	8	West Germany 1; undetermined 7.
Wire ___do	35	43	West Germany 6; Kenya 4; undetermined 29.
Tubes, pipes, fittings ___do	103	109	East Germany 27;[2] U.S.S.R. 15;[2] United States 5;[3] West Germany 4; undetermined 42.
Castings and forgings[2] __do	15	9	West Germany 5; Sweden 3.
Lead:			
Oxide	300	242	All to Yugoslavia.
Metal including alloys, all forms[3]	5,380	500	All to United Kingdom.
Molybdenum metal including alloys, all forms kilograms	7,100	8,505	Sweden 6,000; West Germany 2,500.
Nickel metal including alloys:			
Scrap	151	[2]210	United Kingdom 119; Finland 70.
Unwrought	--	138	All to Belgium-Luxembourg.
Platinum-group metals and silver:			
Scrap __ value, thousands	--	[2]$100	All to West Germany.
Platinum-group metals, unworked or partly worked ___do	$250	$1,667	United Kingdom $1,557.
Silver metal including alloys, all forms[3]	333	348	United Kingdom 104; West Germany 94; Switzerland 63.
Tin metal including alloys, all forms[2]	72	93	United Kingdom 90.
Tungsten metal including alloys, all forms	--	9	Austria 4; Italy 3;[2] West Germany 2.[2]
Zinc:			
Oxide	635	--	
Metal including alloys:[3]			
Unwrought	59,231	43,161	U.S.S.R. 15,722; Hungary 8,792; United Kingdom 5,214.
Semimanufactures	5,119	4,931	U.S.S.R. 1,707; Czechoslovakia 1,231; West Germany 822.
Other:			
Ash and residues nonferrous	[2]26,551	15,093	Austria 8,722; West Germany 5,611.
Metals:			
Metalloids	29	51	France 50.
Nonferrous alloys[2]	4,404	3,398	All to U.S.S.R.
Metal powder[3]	412	2,721	Czechoslovakia 1,663; East Germany 1,010.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum	--	119	Thailand 66; Yugoslavia 53.
Grinding and polishing stones	145	178	Yugoslavia 108; Thailand 34; Greece 26.[2]
Cement[3] __ thousand tons	1,591	2,242	West Germany 581; Austria 414; Switzerland 313; U.S.S.R. 210.
Clays and clay products:			
Crude:			
Fire clay[3]	36,120	26,979	Hungary 17,965; Austria 4,278; East Germany 3,742.
Fuller's earth and chamotte	6,120	5,905	Yugoslavia 4,230; Hungary 1,675.
Other	5,112	986	Spain 311; Yugoslavia 302; Norway 201.
Products:			
Refractory[2]	16,901	15,838	Czechoslovakia 4,507; Albania 3,345; Bulgaria 1,992.
Nonrefractory[2]	3,127	2,669	Sweden 2,524.
Diamond:			
Gem, not set or strung[3] value, thousands	$216	$6	All to Switzerland.
Industrial[2] ___do	$1,084	$1,300	All to Belgium-Luxembourg.
Fertilizer materials, manufactured:			
Nitrogenous[3] __ thousand tons	890	545	India 139; West Germany 121; Egypt 44.
Phosphatic	--	3,216	All to West Germany.
Potassic: Potassium nitrate[2]	8,437	8,342	Yugoslavia 1,391; Italy 1,100; West Germany 1,057.
Other, including mixed	20,959	53,555	Yugoslavia 52,948.
Gypsum stones[3]	62,711	26,470	Hungary 20,796; Denmark 5,674.
Iodine __ kilograms	6,250	3,450	All to Yugoslavia.
Lime[3]	23,235	17,323	Hungary 15,586.
Pigments	1,396	515	Hungary 400; Yugoslavia 115.
Precious and semiprecious stones value, thousands	--	[2]$1	All to Switzerland.
Salt[3]	292,274	307,848	Sweden 189,973; Finland 62,723; Hungary 14,970.
Sodium and potassium compounds:			
Caustic soda[3]	71,823	96,352	West Germany 31,185; Yugoslavia 7,561.
Caustic potash	--	3,663	Sweden 3,402; Singapore 211.
Soda ash[3]	128,587	153,884	U.S.S.R. 59,856; West Germany 27,862; Czechoslovakia 20,800.

See footnotes at end of table.

Table 2.—Poland: Exports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Stone, sand and gravel:			
Dimension stone[3]	46,308	41,643	Netherlands 15,024; Belgium-Luxembourg 10,951.
Gravel and crushed rock[3]	441,787	442,278	West Germany 282,240; United Kingdom 105,878.
Limestone and dolomite[3]	15,314	20,190	West Germany 18,264.
Sand	--	102,507	All to West Germany.
Sulfur:[3]			
Elemental	4,399	4,294	U.S.S.R. 635; France 548; Czechoslovakia 41[illegible]; United Kingdom 410.
Sulfuric acid	185,179	87,411	U.S.S.R. 73,063; Czechoslovakia 7,542; Japan 6,786.
Other:			
Crude	[2]3,715	11,692	West Germany 8,578; France 3,114.
Halogens	[2]6	56,969	West Germany 50,622.
MINERAL FUELS AND RELATED MATERIALS			
Coal:[3]			
Anthracite and bituminous, including briquets thousand tons	39,317	40,106	U.S.S.R. 9,880; France 4,765; Finland 4,0[illegible]; Italy 3,380.
Lignite, including briquets do	3,287	3,332	All to East Germany.
Coke[3] do	2,718	2,086	U.S.S.R. 709; German Democratic Republic 6[illegible]; Hungary 264.
Peat[3]	18,981	19,223	West Germany 6,749; Yugoslavia 5,0[illegible]; Austria 2,667.
Petroleum:			
Crude[3] thousand 42-gallon barrels	37	([5])	All to Denmark.
Refinery products:			
Gasoline do	1,367	[3]2,194	Denmark 716; Switzerland 662; Sweden 4[illegible].
Kerosine and jet fuel do	41	9	All to Hungary.
Distillate fuel oil do	3,724	[2]4,329	West Germany 2,110; Sweden 1,513.
Residual fuel oil do	5,775	[3]2,508	Sweden 862; Denmark 762; Austria 645.
Lubricants do	154	[3]128	Austria 127.
Other:			
Liquefied petroleum gas do	328	[3]360	West Germany 133; Denmark 125; Italy 91.
Mineral jelly and wax do	1	[2]3	Mainly to Netherlands.
Nonlubricating oils do	151	NA	
Bituminous mixtures do	--	1	Mainly to United Kingdom.
Unspecified do	4,194	4,685	NA.
Total do	15,735	14,217	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	[2]34,244	69,232	West Germany 36,003; France 17,968; Austria 8,978.

NA Not available.

[1] Unless otherwise specified, data are compiled from official trade statistics of individual trading partners. Owing to the lack of official trade data published by Poland, this table should not be taken as a complete presentation of Poland's mineral trade. These data have been compiled from various sources which include United Nations information, data published by the trading partners, and partial official trade sources of Poland.

[2] 1977 and 1978 editions of the World Trade Annual, prepared by the Statistical Office of the United Nations, Walker and Co., New York, 1979 and 1980.

[3] Official trade statistics of Poland.

[4] Quarterly Bulletin of Steel Statistics for Europe, United Nations, New York.

[5] Less than 1/2 unit.

Table 3.—Poland: Imports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite[3]	115,298	100,558	Hungary 80,147; Australia 12,[illegible]; Yugoslavia 7,503.
Alumina[3]	289,553	311,209	Hungary 146,603; Yugoslavia 107,4[illegible]; United States 46,004.

See footnotes at end of table.

Table 3.—Poland: Imports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Aluminum —Continued			
Metal including alloys:			
Unwrought	14,758	29,759	Hungary 25,937; Iceland 2,587; West Germany 1,153.
Semimanufactures[3]	32,904	39,710	U.S.S.R. 9,400; Switzerland 5,160; Czechoslovakia 4,212.
Bismuth metal including alloys, all forms	7	2	All from Japan.
Cadmium metal including alloys, all forms	5	--	
Chromium:			
Chromite[3]	215,604	198,540	U.S.S.R. 113,518; Albania 37,108; Iran 15,336.
Oxide and hydroxide	--	[3]6	All from United Kingdom.
Metal including alloys, all forms	20	--	
Cobalt metal including alloys, all forms	42	4	Canada 3; West Germany 1.
Copper:			
Ore and concentrate	5,058	--	
Metal including alloys:[3]			
Unwrought	1,023	589	All from U.S.S.R.
Semimanufactures	10,701	6,237	Czechoslovakia 3,104; West Germany 903.
Gold, unworked or partly worked kilograms	39	NA	
Iron and steel:			
Ore and concentrate[3] thousand tons	16,943	17,198	U.S.S.R. 11,560; Sweden 3,239; Brazil 1,933.
Metal:			
Scrap do	30	[4]9	NA.
Pig iron do	[3]1,752	[3]1,710	U.S.S.R. 1,527;[3] West Germany 114.[3]
Ferroalloys[3] do	69	108	Norway 45; Switzerland 21; U.S.S.R. 12.
Steel, primary forms do	[4]83	[4]31	West Germany 8;[3] East Germany 6;[3] undetermined 13.
Semimanufactures:[4]			
Bars, rods, angles, shapes, sections do	957	709	West Germany 71; Hungary 51; Belgium-Luxumbourg 19;[3] undetermined 493.
Plates and sheets do	704	761	West Germany 131; Czechoslovakia 120;[3] East Germany 63;[3] U.S.S.R. 60;[3] undetermined 131.
Hoop and strip do	76	89	West Germany 58; Austria 13;[3] Belgium-Luxembourg 10[3].
Rails and accessories do	145	119	Canada 19;[3] Italy 8;[3] undetermined 64.
Wire do	37	47	Belgium-Luxembourg 3;[3] Sweden 2;[3] undetermined 13.
Tubes, pipes, fittings do	398	325	West Germany 64; East Germany 28;[3] Italy 24;[3] France 23;[3] undetermined 39.
Castings and forgings do	43	53	NA.
Lead:			
Ore and concentrate	--	33,774	All from Yugoslavia.
Oxide	31,454	297	All from United Kingdom.
Metal including alloys, all forms[3]	9,384	9,580	Australia 5,120; U.S.S.R. 4,061
Magnesium metal[3]	943	1,789	Norway 1,178; United States 361; Switzerland 150.
Manganese:			
Ore and concentrate[3]	697,863	651,414	U.S.S.R. 450,767; France 132,584; Hungary 42,460.
Oxide	1,797	[3]1,675	Greece 845; Ireland 830.
Metal including alloys, all forms	--	79	All from France.
Mercury 76-pound flasks	29	5,597	Spain 4,901; Italy 696.
Molybdenum:			
Ore and concentrate	[5]50	169	Netherlands 140; Sweden 27.
Metal including alloys, all forms	15	--	
Nickel metal including alloys:			
Unwrought	[3]215	168	Belgium-Luxembourg 138;[3] Netherlands 17.
Semimanufactures[3]	589	345	France 211; United Kingdom 93.
Platinum-group metals, all forms[3] value, thousands	$2,040	$3,492	West Germany $3,0[illegible]; Switzerland $379.
Silver, unworked or partly worked[3] do	$856	$908	France $496; West Germany $354.
Tellurium, elemental kilograms	1,479	--	

See footnotes at end of table.

Table 3.—Poland: Imports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Tin:			
Oxide	22	--	
Metal including alloys, all forms[3]	4,680	4,616	United Kingdom 3,148; Bolivia 970.
Titanium:			
Oxide, dioxide, anhydride	5,516	2,016	United Kingdom 1,301; West Germany 505.
Metal including alloys, all forms kilograms	300	--	
Tungsten:			
Concentrate[3]	3,360	4,103	United Kingdom 3,523; Mainland China 355.
Metal including alloys, all forms kilograms	2,076	1,742	Japan 934; West Germany 800.
Zinc:			
Concentrate[3]	68,451	28,640	United States 18,588; Norway 10,002.
Oxide	--	[3]10	All from United Kingdom.
Metal including alloys:			
Unwrought[3]	2,624	2,520	U.S.S.R. 1,536; Norway 945.
Semimanufactures	40	[3] [5]56	Italy 40; United Kingdom 15.
Zirconium ore and concentrate	250	--	
Other:			
Ores and concentrates[3]	501	68,190	Norway 68,090.
Ash and residue, nonferrous	[5]10	125	West Germany 124.
Oxides of magnesium, strontium, barium	31,351	--	
Oxides, hydroxides, peroxides, n.e.s	288	121	United Kingdom 107;[3] West Germany 12.
Metals:			
Metalloids	1,250	1,791	Norway 1,463; Yugoslavia 298.
Nonferrous alloys[3]	--	383	All from U.S.S.R.
Metal powder[3]	853	885	All from East Germany.
Base metals including alloys, all forms, n.e.s	980	[5]137	France 79; West Germany 28.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum[3]	1,103	733	All from Italy.
Powder of precious and semiprecious stones kilograms	102	43	All from Belgium-Luxembourg.
Grinding and polishing stones	[5]4,378	3,702	Austria 1,225; West Germany 862; Yugoslavia 710.
Asbestos[3]	87,728	102,376	U.S.S.R. 61,591; United Kingdom 19,198; Italy 9,361.
Barite[3]	14,280	21,653	East Germany 9,849; West Germany 9,573.
Boron oxide and acid	260	NA	
Cement[3] thousand tons	263	286	U.S.S.R. 285.
Chalk	--	[5]109	Sweden 99.
Clays and clay products:			
Crude:			
Bentonite	4,506	3,962	All from Hungary.
Fire clay[3]	8,559	15,521	U.S.S.R. 7,891; France 3,863; East Germany 2,038.
Fuller's earth and chamotte[3]	26,742	28,942	U.S.S.R. 25,913; Bulgaria 2,330.
Kaolin[3]	161,034	185,221	United Kingdom 72,595; Czechoslovakia 72,559.
Products:			
Refractory[3]	101,625	68,473	Czechoslovakia 18,016; West Germany 11,726; Austria 8,070; Yugoslavia 5,802.
Nonrefractory[3]	7,000	3,263	All from Spain.
Diamond:[3]			
Gem, not set or strung value, thousands	$88	$273	Belgium-Luxembourg $204; United Kingdom $69.
Industrial do	$5,519	$6,139	Belgium-Luxembourg $6,138.
Diatomite and other infusorial earth	[5]366	174	All from United States.
Feldspar and fluorspar[3]	72,315	86,640	United States 31,259; Spain 11,414; East Germany 10,922.
Fertilizer materials:			
Crude, phosphatic[3] thousand tons	3,588	3,255	Morocco 998; United States 862; U.S.S.R. 467; Togo 343.

See footnotes at end of table.

Table 3.—Poland: Imports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Fertilizer materials —Continued			
Manufactured:			
Nitrogenous, N content[6] thousand tons	51	106	NA.
Phosphatic	31,831	--	
Potassic[2] thousand tons	2,979	2,436	U.S.S.R. 1,718; East Germany 692.
Other, including mixed	--	2,978	Belgium-Luxembourg 2,878.
Ammonia[3]	110,766	98,733	Austria 39,840; U.S.S.R. 26,822; Hungary 17,546.
Graphite[3]	10,025	11,906	Austria 7,973; U.S.S.R. 3,275.
Gypsum and plasters	4,851	6,776	West Germany 6,600.
Magnesite[3]	296,472	316,668	North Korea 101,503; Czechoslovakia 66,220; Brazil 41,220.
Mica, all forms[3]	1,902	1,641	India 1,505.
Pigment: Iron oxides, processed	1,965	2,921	West Germany 1,606; Canada 1,072.
Precious and semiprecious stones[3] value, thousands	$684	$274	West Germany $135; Switzerland $36.
Salt	153	78	All from Canada.
Sodium and potassium compounds:			
Caustic potash	60	NA	
Soda ash[6]	24,100	36,100	NA.
Stone, sand and gravel:			
Dimension stone	[5]81	178	Austria 144; Sweden 30.
Gravel and crushed rock[3]	20,493	22,852	Norway 11,037; Finland 4,553; Albania 3,296.
Limestone and dolomite[3]	10,862	11,130	All from Hungary.
Quartz and quartzite	2,340	3,440	West Germany 3,044.
Sand	--	94	Austria 84.
Talc[3]	24,081	25,540	North Korea 8,997; Czechoslovakia 6,615; Finland 6,463.
Other:			
Crude	10,499	15,181	Hungary 10,119; West Germany 5,093.
Halogens	119	211	Japan 153; United Kingdom 58[5].
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	9,450	6,993	West Germany 5,332; Sweden 896.
Coal, anthracite and bituminous, including briquets[3] thousand tons	1,121	1,074	U.S.S.R. 762; East Germany 312.
Coke[3] do.	1	364	All from Italy.
Gas, natural[6] million cubic feet	97,393	97,221	All from U.S.S.R.
Petroleum:[3]			
Crude thousand 42-gallon barrels	120,380	122,147	U.S.S.R. 98,255; United Kingdom 9,289; Iraq 8,549.
Refinery products do.	25,000	25,650	U.S.S.R. 15,630; Romania 960.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals[3]	4,244	--	

NA Not available.

[1] Unless otherwise specified, data are compiled from official trade statistics of individual trading partners. Owing to the lack of official trade data published by Poland, this table should not be taken as a complete presentation of Poland's mineral trade. These data have been compiled from various sources which include United Nations information, data published by the trading partners, and partial official trade sources of Poland.

[2] Official trade statistics of Poland.

[3] 1977 and 1978 editions of the World Trade Annual, Statistical Office of the United Nations, Walker and Co., New York, 1979 and 1980.

[4] Quarterly Bulletin of Steel Statistics for Europe, United Nations, New York.

[5] Partial figure; tonnage not available for all sources.

[6] Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow.

COMMODITY REVIEW

METALS

Aluminum.—The aluminum industry experienced severe domestic raw material shortages and depended on imports of bauxite and alumina. Poland has signed a 10-year agreement with Yugoslavia for delivery of 1.2 million tons of alumina in the period from 1976 to 1985. Alumina was also imported from Hungary and Australia. Skawina and Konin were the principal aluminum production centers in Poland in 1978 and 1979. In the near future, they are to increase their production. The aluminum smelting plant at Skawina was Poland's largest producer of aluminum with an output of some 60,000 tons per year. The basic production facility consisted of 300 Soviet-made pots, each producing about 1.5 tons of aluminum metal in one 3-day cycle. Approximately 70% of the plant's aluminum production is used for aluminum wire and electrical cable.

Over the next 5 years (1981-85), a $50 million expansion, with emphasis on high-technology modernization, is expected to raise capacity of aluminum plants to 140,000 tons per year. Expansion does not include provisions for a sheet-rolling mill. All sheet aluminum was produced at Poland's other large aluminum plant at Konin. The Konin plant was slightly smaller than Skawina plant and it used French-licensed equipment. The Skawina plant employed some 2,500, workers including 400 engineers and technicans, in 1979. In 1978, negotiations were under way for sales of U.S. air pollution control equipment, valued at $3 to $4 million, for Polish aluminum industry.

In 1979, experimental equipment to produce alumina from the dust emitted by the Turszow powerplant was put into operation at the Wiozow chemical plant (Wroclaw Region).

Rocks highly enriched in aluminum, including bauxite layers, were discovered recently in the northeastern part of the Lublin coal basin. At three localities bauxite of economic value was found.[29]

Cadmium.—Polish smelter production of cadmium is derived as byproduct from zinc ores of domestic origin. The bulk of cadmium production is destined for export markets, principally for shipment to the U.S.S.R. and the United Kingdom.

Copper.—The 1978 plan provided for 360,000 tons of electrolytic copper to be produced, but the Glogow 2 smelting and refining plant was not commissioned on time and the planned quota was not fulfilled. In 1979 the annual plan provided for 400,000 tons of refined copper, and this target also was not met.

It is expected that the copper plants will deliver 425,000 tons of refined copper in 1980 and about 500,000 tons in 1983. About 44% of the total electrolytic copper and copper products were exported in 1979 to the Federal Republic of Germany, the

United Kingdom, Holland, France, Czechoslovakia, Romania, the German Democratic Republic, and the U.S.S.R. The continuously increasing Polish copper exports have placed Poland among the leading copper exporting countries.

In the 1978-79 period copper ore was mainly extracted from the Lubin, Polkowice, and Rudna mines, located in the Legnica-Glogow region, about 40 miles northwest of Wroclaw. A fourth mine, the Sieroszowice mine, located in the same area, was under development. The sinking of the first shaft at the mine began in July 1979. It is to be 920 meters deep and is to be put into operation at the end of 1981. When the first stage of development of the mine is completed in 1983, the mine is to produce 5,500,000 tons of ore a year. Projected mine capacities are as follows: Lubin, 7 million tons of ore per year; Polcawice, 8 million; Rudna, 12 million; and Sieroszowice, 12 to 15 million tons of ore per year.

It is expected that the Rudna mine will reach full capacity after 1980. Expansion of the Rudna concentration plant was in progress in 1978, and trial of equipment started at the end of 1979. The plant is to reach the capacity of 12 million tons of ore per year.

The first section of the ore-dressing plant at the Lubin copper mine was renovated in 1978 and its capacity increased from 4.5 million tons of ore per year to 7.5 million tons. The metal content of the concentrate also increased.

The copper ore deposits lie at a depth from 600 to 1,500 meters below the surface and consist of sulfide ores. Typical minerals are bornite, chalcocite, chalcopyrite, galena, and sphalerite. The average copper content was estimated at 1.4%. Associated with the copper are silver, lead, cobalt, vanadium, and other elements.[23] According to the Lubin officials, the known copper ore reserves are estimated to last for about 35 years at the planned rate of production. Two main smelters, one at Legnica with 88,000 tons of electrolytic copper per year and one at Glogow with 180,000 tons of electrolytic copper per year, were in operation in 1978.[24] The new Glogow 2 plant, with a projected capacity of 150,000 tons of electrolytic copper per year, was commissioned in 1978. The smelter was closed for 45 days in 1979 for routine overhaul. The Outokumpu flash-smelting technology was used in Glogow 2 plant. The next planned project of this type is to be located at Orsk, near Lubin.

In 1979 a new copper rolling mill was commissioned at Orsk, with an annual processing capacity of 100,000 tons.

Large credits from the U.S. and other Western banks have been used to finance Lubin's development. In February 1978, a 15-bank syndicate managed by Chase-Manhattan signed a $250 million loan for development of Sieroszowice mine and construction of the Orsk smelter and continuous casting wire rolling mill.

The Polish copper industry operates under the administration of the organization called Copper Combinate. Scientific research on the technology of production is led by the Cuprum Plans Office in Wroclow, Institute for Nonferrous Metals in Gliwice, and Bipromet Plans Office in Katowice. In 1978, the Polish Impexmetal of Warsaw and the Colombo SpA of Italy signed a contract for the delivery to Italy of 20,000 tons of copper over 4 years. The deal is to be financed by a $20 million credit from the Banca Commerciale Italiana to Bank Handlowy in Warsaw.

In May 1979, under a contract concluded by the Impexmetal Corporation in Warsaw with West German firms, including Siemens, Metallgesellschaft and Kabelmetall, 480,000 tons of copper is to be exported to the Federal Republic of Germany in 1979-90. At the same time the agreement of 1976 on semifinished copper products and cable was extended.

Gold.—Some gold has been discovered in western Poland, and placer mining is beginning along some mountain streams. Polish mining engineers are operating on the assumption that a concentration of 100 milligrams of gold per cubic meter of material is the minimum economic amount for a start-up of mining operations.[25]

Iron and Steel.—The Polish economy lacks most of all iron ores which are imported in large quantities from the U.S.S.R. (Krivoi Rog), Sweden (Kiruna), and Brazil.

In 1978 and 1979, iron ore was extracted in Poland from seven mines located in the Czestochow District (which gives some 80% of the total output) and in the Leczyca District.[26] Iron ore deposits in Poland are marginal, with an average metal content of approximately 30% to 35%. The Polish production of iron ore only partly meets the needs of the national demand.

In 1979, exploration of the rich magnetite iron ore deposits continued near Suwalki in the northeast of Poland.

Crude steel production in Poland in 1979 remained at the 1978 level. The plan calls for the production of 22.2 million tons of crude steel in 1980 and 25 million tons by 1985. Steel consumption for 1980 is planned at about 22 to 23 million tons. The 1990 plan for steel consumption is about 31 to 33 million tons. About 15% of the total volume of steel produced in 1979 was high-quality steel.[37]

Ferrous alloys are produced in Poland only at Siechnice and Laziska plants.

The decline in imports of steel rolled products in 1978 and 1979 was partly due to increasing production of rolled steel at the new Katowice steel complex.

The largest iron and steel plants in Poland are the Lenin steel plant in Krakow and the new Katowice steel complex, located about 40 miles west of Krakow.[38]

The Lenin metallurgical complex produced 6.7 million tons of steel, 4.8 million tons of pig iron, 4.5 million tons of rolled products, and 4.1 million tons of coke in 1979.

The general modernization of the No. 5 blast furnace, the biggest at the Lenin complex with a volume of 2,000 cubic meters, was completed in 1979. As a result, the furnace will be able to produce 4,000 tons of pig iron a day, 500 tons more than previously.

The Katowice metallurgical complex produced 4 million tons of steel and 3.1 million tons of rolled products in 1978 and 4.5 million tons of steel in 1979; about 0.5 million tons of steel, produced at the complex, was exported to the market economy countries in 1979. The large rolling mill at the Katowice steel complex was commissioned in July 1978, and the first stage of the complex was completed.

In 1979 there were two sintering machines, a blast furnace (3,200 cubic meters), two converters each with a capacity of 300 tons, and a blooming-slab mill operating in the Katowice complex. Within the next 2 or 3 years, it is planned to put in operation two sintering lines, two blast furnaces, a third converter, four continuous-casting machines, and a 2,000 millimeter broad-strip hot rolling mill.

French specialists were cooperating in the design and construction of new types of furnaces for the 2,000 millimeter continuous hot-sheet plants at the Katowice complex in 1979.

There are no plans to increase capacity of Katowice steel complex beyond 9 million tons per year (two stages each of 4.5 million tons capacity) or to produce any products other than basic steel shapes and sheets. The share of Katowice steel complex in total domestic production of the iron and steel industry is to be as follows (in percentage):

Production	First stage	Second stage
Pig iron	33	47
Steel	21	[illegible]
Hot rolled products	16	[illegible]

The total employment at the complex, including production, maintenance, and auxiliary services, was 17,500 men in 1978.

The construction of the second stage of the transloading station for Katowice steel complex, 5 kilometers from the steelworks, was in progress in 1978 and was completed in 1979. Raw material will be shipped from the station to the steelworks along a 5-kilometer conveyor belt directly to the sintering plant. The wide-gauge (1,524-millimeter) railroad from the U.S.S.R. to the Katowice transloading station was completed in December 1979.

New installations put into operation in 1978 also included an electric steel melting shop for high alloyed grades of steel, with an annual capacity of 75,000 tons at Huta Baildon and equipment for expansion of existing heavy plate mill by 300,000 tons per year at Huta Bieruta.

In 1979, work was in progress to complete the following installations: (1) small section mill at the Nowatko plant, with an annual capacity of 800,000 tons; (2) further expansion of heavy plate mill at Bieruta by 430,000 tons per year; (3) expansion of the Tandem mill for cold-rolled sheets at Lenin complex by 400,000 tons per year.

Construction of seamless tube plant began at Siemianowice in 1979, which is designed to produce 400,000 tons of pipes per year.

Lead and Zinc.—Zinc and lead mining is concentrated in the Katowice area, where three major mines (Boleslaw, Olkusz, and Pomorzany) were in operation in 1978-79. Most of the mineralization in this region occurs in the ore-bearing Triassic dolomites.[39] Ores are generally about 250 meters deep with ground water problems. The Olkusz mine has a capacity of 4.6 million tons per year. The Pomorzany new lead-zinc mine, with designed capacity of 4 million tons per year, produced an estimated 2 million tons of ore in 1978. The mine, with a concentration plant, is part of the Boleslaw mining and metallurgical complex at Bukowina, near Krakow. The Boleslaw complex incorporates the zinc-lead ore mines, ore dressing plant, agglomerating plant, zinc refinery, lead plant, and sulfuric acid plant.

Poland's second Imperial smelting furnace was unable to come onstream as planned in October 1979; however, operation of the smelter was expected to start shortly. The smelter is to produce 52,000 tons per year of zinc and 23,000 tons per year of lead, using local concentrates.

It is planned to increase lead-zinc ore production from deposits discovered in the Olkusz-Chrzanow and Zawiercie region. In the Zawiercie region, it is planned to develop one mine with 2.5 million tons of ore per year and another mine with a capacity of 1 million tons after 1980. Two mines (Pomorzany II and Irzebionka) also are to be developed in the Olkusz-Chrzanow area. The target for 1980 calls for the production of 120,000 tons of lead and 260,000 tons of zinc.

Silver.—The largest share of total Polish primary silver production was as a byproduct of copper from the Legnica-Glogow region, about 65 kilometers northwest of Wroclaw. The balance of the Polish primary output is derived as a byproduct of lead-zinc mining.

Silver exports were expected to reach 13 million ounces in 1980, up from 9.5 million ounces in 1979. Silver hard-currency earnings equal approximately those from copper.

Other Metals.—Molybdenum, cobalt, germanium, gallium, selenium, tellurium, and rhenium are found and produced as byproducts from the polymetallic and copper ores. The Nonferrous Metals Institute in Gliwice has developed a method of obtaining rhenium from complex ore. The method is being introduced at the copper plant in Glogow.

A deposit of tin ore (cassiterite) has been found in the Sudety Mountains west of Jelenia Gora, and it is thought that exploitation will be profitable. Mining is to be started at the end of 1980.

NONMETALS

Barite.—Trials of equipment have begun at the newly built barite concentrator at Boguszow near Walbrzueh in July 1979. The enterprise, which has the only barite mine in the country, produces annually over 90,000 tons of barite, which satisfies about 60% of the national requirement. The new concentrator will make it possible to increase production substantially and to eliminate costly imports. The concentrate will have a pure barite content of 95%. Fluorite, which has never previously been produced in Poland, can also be obtained from the barite ore.

Cement.—There are 25 cement plants in operation in Poland. A new plant at Gorazdze (Opole) in the southwest went into full capacity of 2.4 million tons of cement in 1978; however, cement production in 1979 was decreased signifantly. The Przjazn II cement plant near Padom, with the capacity of 2.2 million tons of annual production, continued to be under construction in 1979 and was scheduled to be commissioned in 1980.[30] It is planned to produce 28.6 million tons of cement in 1980 by attaining full production capacity in new plants, as well as by the modernization and expansion of old ones.

Construction of new cement plants is based on supplies of machinery for the cement industry from the U.S.S.R. and the German Democratic Republic.

During the 1978-79 period, a large cement-handling center was under construction near Cigacice on the Odra in the Zielona Gora Province. This port is to greatly improve the delivery of cement, mostly from the Gorazdze cement plant, to the interior of Poland.

Fertilizer Materials.—There were five main nitrogen fertilizer plants in operation in Poland in 1978 and 1979. Over one-half of the output of nitrogen fertilizers was supplied by the nitrogen plant in Pulawy, built in 1966. Four others are located in Wloclawek, Tarnow, Chorzow, and Kedzierzyn.

Plants are concentrated in the southeastern region of the country close to indigenous supplies of gas, and further north, where Soviet gas is supplied.

Currently Poland produces more nitrogen fertilizers than it consumes. Consumption has tended to stagnate in recent years at about 1.2 million tons per year.

A new ammonia installation, with a capacity of 500 tons per day, is planned to be constructed in Pulawy to supplement the existing plant.[31]

In 1978, the Wloclawek plant, built in 1971, operated two 750-ton-per-day ammonia lines, far below its capacity. In 1978, the Creusot Loire of France was awarded a contract by the Polish Polimex Cekop to expand the plant. Reconstruction of the plant is due to start in the near future, and it is expected that it will take approximately 2 years for total production of ammonia to reach its new capacity of 1,650 tons per day. The Tarnow nitrogen plant produced about 175,000 tons of nitrogen fertilizers per year. Construction of a large ammonia plant is to begin at Tarnow (Tarnow III) in the future.[32]

The Police II 500,000-ton-per-year natural-gas-based ammonia plant was under construction in 1979. Production at this plant is scheduled to begin in the first half of 1981.

The planned ammonia-urea project, based on a coal gasification plant at Libiaz, was postponed in 1979. The plans were made for a new project based on natural gas and not on coal as originally planned. The new project at Kedzierzin will comprise a plant producing 1,500 tons per day ammonia and three 900-ton-per-day urea units. The final plans for the construction of this complex have to be made by the June 30, 1980, expiration date of the Germany credits.[33]

The Tarnolerzeg, Police, Lubon and Krakow plants producing phosphatic fertilizers were in operation in 1979. The Lubon plant produced 150,000 tons of superphosphate in 1978 and supplied 10,000 tons more in 1979. The chemical plants at Police, founded in 1969, manufactured 920,000 tons of compound fertilizers and 400,000 tons of sulfuric acid in 1978.

Construction of the Police II nitrophosphate complex began in 1976. The contract was awarded by Cekop to a West European consortium headed by Creusot-Loire of France. It is expected that the whole project will be completed in 1983 when the Police II complex will produce annually 500,000 tons of ammonia, 400,000 tons of urea, and 823,000 tons of NPK fertilizers. However, as a result of limited funds in 1978 and 1979, a number of key projects in Poland were hit by delays, including the Police II fertilizer complex.

The Poles started to build their own port on the Oder River at Police in 1978 to ship fertilizers by water transport to the interior of Poland. The first stage of construction is to handle about 1.5 million tons of goods.

Gypsum.—One of the richest European deposits of gypsum is located in Poland in the Nida Valley. It is exploited by the Dolina Nidy mining-processing complex located near Pinczow.

Polish exports of gypsum stone run up to several hundred thousand tons a year. The main importers are Sweden, Denmark, Norway, Finland, and Hungary.

Salt.—In 1978 and in 1979 production was principally derived from salt mines and salines in Inowroclaw, Klodawa, and Wapno in the central part of Poland. The oldest salt mines in Wieliczka and Bochnia were of less economic importance. There were 12 salt mines and plants in operation in Poland in 1979, and they employed about 5,000 people. Poland's total salt reserves amounted to 43.5 billion tons. A new mine, which was under development at Moszczenica in Tarnov Province, is to replace old mines at Bochnia and Wieliczka. This mine is to go into operation in 1984 and is to produce initially about 600,000 tons of salt. Construction of the Moszczenica mine is estimated to cost Z1.9 billion. In 1979 the first shaft (Siedlec) of this mine, which is 480 meters deep, was completed, and work started on the construction of the second shaft.

In the biggest salt mine in the country, at Klodawa in Konin Province, a new level was under developmet at a depth of 750 meters. When it goes into production, the mine's output will be increased by 150,000 tons.

Sulfur.—The Grzybow mine, with an annual output of 1.5 million tons of sulfur, Jeziorko (about 3 million tons), and the Machow mine, located in the rich sulfur fields around Tarnobrzeg, were the principal contributers of sulfur production in 1978.[34] In the first two mines, the sulfur was extracted by the Frasch method. Machow is the opencast mine where the sulfur is extracted by excavators.[35] The output of sulfur in 1978 was the highest so far produced in Poland. The experimental Baszina Mine in the Preusl region produced over 24,000 tons of sulfur in 1978. Sulfur production in this mine is expected to increase to 50,000 tons per year. A new mine is planned to be developed near Baranow after 1980. In the first 2 months of 1979, Polish deliveries for both domestic and export markets were totally disrupted by severe weather conditions. Of the existing mines, only Grzybow was unaffected by the cold weather. The Machow openpit was put out of production almost through the entire 1979 year.[36] Production of sulfur at Jeziorko Mine was also declined. The rail transportation system in Poland was paralyzed by snow and ice in the beginning of 1979, and the number of sulfur shipments out of Gdansk was greatly reduced. Polish sulfur exports to the market economy countries totaled 633,000 tons in the third quarter of 1979, representing a fall of 9% from third quarter 1978 deliveries. Over the first 9 months of 1979, Polish sulfur exports to the market economy countries were down 22% to 1.47 million tons. Deliveries to the centrally planned countries were expanded, however; for the first 9 months of 1979, CMEA countries imported 1.33 million tons of Polish sulfur, an increase of 0.11 million tons over the first 9 months of 1978. The bulk of the sulfur exports is handled by the Gdansk-based State Foreign Trade Enterprise Siarkopol.

Chemadex, a Krakow-based corporation, contracted for the delivery of 3 sulfuric acid plants worth R56 million to the U.S.S.R. in 1977-78 as part of a total of 15 Polish sulfur plants to be built in the U.S.S.R. by 1980.

Under an initial contract between Poland and Occidental Petroleum of the United States, approximately $25 million worth of Florida phosphate rock will be shipped to Poland during 1980. Since Poland does not have enough sulfur available to make barter payments, Oxy has agreed to make delivery on the basis of a long-term credit. It is expected that Oxy will be able to provide a credit for additional sulfur development since all current and future prodction from existing mines has already been committed for domestic use and to foreign buyers.

MINERAL FUELS

Coal, including lignite, has been the major source of primary energy in Poland. In 1979, the total primary energy production was 229.2 million tons in standard coal equivalent (SCE), an increase of 9.8 million tons over that of 1978. Coal (lignite and bituminous) contributed 93.8%; crude oil, 0.2%; natural gas, 4.7%; and others (peat, wood, and hydropower), 1.3%. Total consumption of all types of primary energy reached 218.1 million tons SCE with coal providing 78.9%; petroleum 13.0%, natural gas 6.7%, and hydropower, peat, and wood about 4%. In 1979, the total apparent consumption of primary energy increased 5.7% over that of 1978. The energy balance for 1978 and 1979 is shown in table 4.

Table 4.-Poland: Total primary energy balance for 1979 and 1978

(Million tons of standard coal equivalent)[1]

	Total primary energy	Coal (lignite, bituminous) and coke	Crude oil and petroleum products	Natural gas	Others
1979:					
Production	229.2	214.9	.6	10.7	3.0
Imports	35.4	1.0	30.5	3.9	--
Exports	46.5	43.9	2.6	--	--
Apparent consumption	218.1	172.0	28.5	14.6	3.0
1978:					
Production	215.44	204.5	.6	10.6	3.3
Imports	32.8	1.1	28.3	3.4	--
Exports	45.9	43.0	2.9	--	--
Apparent consumption	206.3	163.0	26.0	14.0	3.3

[1] 1 ton of standard coal equivalent (SCE) = 7 million kilocalories. Conversion factors used are from the United Nations as follows: hard coal, 1.0; brown coal, 0.3; coke, 0.9; crude oil, 1.47; petroleum products, 1.54; natural gas (1,000 cubic meters), 1.33.

Sources: Biuletyn Statystyczny (Statistical Bulletin) (Warsaw). No. 10, 1979, pp. 14, 32, 34. Rocznik Statystyczny (Statistical Yearbook). Warsaw, 1979, p. 137.

Coal.—In 1978-79, Poland continued to undertake efforts to expand coal output in order to increase exports and to ensure the maximum degree of national energy self-sufficiency. Bituminous coal production is planned to reach 207.5 million tons in 1980, 240 million tons in 1985, 260 million tons in 1990, and approximately 300 million tons in 2000.[27] In 1979, bituminous coal exports were equally divided between centrally planned economy countries and market economy countries. Poland is one of the world's largest producers of lignite, which is used mainly by local electric power stations. Lignite production is planned to reach 42 million tons in 1980, 85 million tons in 1985, 140 million tons in 1990, and approximately 250 million tons in 2000. Hard coal is located in three basins: the Upper Silesian, Lower Silesian, and Lublin.

The Upper Silesian basin produced 98% of the total hard coal output in 1978 and about the same percentage in 1979. About 60% of total Polish coal output was suitable for coking. The production of hard coal came from deep underground mines, average mining depth of which was estimated at 517 meters in 1978 and 533 meters in 1979. The average excavation depth will be approximately 600 meters by 1985. There were 65 mine administrations producing coal and 2 experimental mines in operation in 1979. The average production from one mine administration was about 9,500 tons per day. About 87% of total hard coal production was obtained from mines using the longwall system of mining. The prevailing longwall face was about 200 meters.

In 1978 the mines obtained over 150 power supports, over 240 wall cutter loaders, and over 60 heading machines. Adoption of a four-brigade (four-shifts) organization of labor began in 1978 at the mines of the Upper Silesian Basin. It is anticipated that the four-brigade system will be adopted at all coal mines by the end of 1981.[38]

Renovation and development of mines in the Upper Silesian coal basin, including the Rybnic region, continued in the 1978-79 period. Among new mines under development were the Swierclany, Suszec, Kaczyce, Czeczot, and Orantovice mines. The Swierclany mine (two shafts) began operation in December 1979. In 1980, this mine is to produce 1,600 tons of coal per day (projected capacity is 8,000 tons per day). The Suszec mine is to reach its target output of 12,000 tons per day in 1986. The first output of coal is planned for 1982. Sinking of the two shafts at the Czeczot mine, with projected capacity of 24,000 tons per day, was well advanced in 1979. First production of this mine is expected in 1983 at the depth of about 600 meters. Development of the Orantovice mine started in 1978 in the Upper Silesian field. It is expected to yield 20,000 tons per day from seams at 1,000 and 1,500 meters depth in the 1990's.

The Ministry of Mining reported that the process of expansion and overall modernization of mining enterprises will continue in the period running up to 1985. The modernization program encompasses 18 mines presently in operation. Renovation activities will include the Brzeszcze mine (targeted production growth to 16,000 tons per day), Ziemowit (to 27,000 tons per day), Lenin (to 25,000 tons per day), Halemba (to 24,000 tons per day), and other mines. The possibility of overall renovation of the Murcki, Knurow, and Debiensko mines was also studied.

To obtain the required quantity and quality of fuels by 1985, about 50 coal preparation plants are to be modernized and enlarged and 7 new ones built.[39]

Work was progressing in the new Lublin hard coal basin in 1978 and 1979. With the completion of the first stage of the project scheduled for 1990, its annual output is to be 25 million tons. Seven mines are to be developed in the Lublin Basin in the near future. The first million tons of coal was expected to be produced in 1981.

More than Z1,800 million were invested in the development of the first Bogdanka Mine in the Lublin Basin in 1979. In the past 4 years (1975-78), Z3,300 million was invested in the mine. All of the coal in the Lublin Basin will be extracted by longwall mining. The coal seams are about 1.5 to 2.0 meters thick and are comparatively flat, however, most of the deposits contain high concentrations of methane.

The Polish press reported that a coal dust explosion on October 10, 1979, at a mine at Bytom (near Katowice) resulted in the death of 33 miners and the hospitalization of 3 others. The explosion occurred at a depth of 774 meters where 43 miners were working. Another coal mining accident occurred October 3 in a mine near Walbrzych in southwestern Poland. According to a report published in Zycie Gospodarcze, seven miners perished and three were hospitalized.

Lignite is the second most important fuel for the Polish power industry.

In 1979, six lignite strip mines were in operation with a total annual average employment of about 13,000 people. Lignite deposits are located in the central and western parts of the country. The main basins are the Turoszow, the Konin, the Adamov, and the Belchatow Basin (under development). The Turnow Basin accounted in the years 1978-79 for about 61% of the total lignite production in Poland, the Konin Basin for 28%, and the Adamov for 10%.[40] About 90% of lignite was used for electric energy generation. The remainder was halved between export and heating purposes.

Three excavators were working at the site of the Belchatow opencast mine in 1979. In August 1979, the mine was 2,300 meters long, more than 1,000 meters wide, and about 80 meters deep. About 40 million cubic meters of overburden were removed at the yearend of 1978 and another 100 million tons had to be removed before the lignite could be moved. The lignite lies at the depth of 150 meters. The first stage of the Belchatow complex is to be commissioned in 1980. Belchatow is to have annual capacity of 40 million tons per year when it is fully developed. Reserves of this basin are estimated at 2.3 billion tons. The Belchatow project includes two power stations each with a generation of 4,300 megawatts.

About eight new large lignite strip mines (besides Belchatow Mine) are planned to be developed in western and central Poland in the next 20 years.

According to the Polish Central Geological Board's estimate, Poland's minable reserves in place of hard coal in categories A+B+C1+C2 amounted to about 57,500 million tons (on January 1, 1974), of which 19,600 million tons was surveyed in categories A+B+C1 (measured, indicated, and inferred) and 37,900 million tons in category C2 was classified as speculative.[41] Poland's ultimate hard coal resources are estimated at about 75 billion tons. Total lignite reserves are estimated at 36 billion, of which about 15 billion tons are recognized as economically minable.[42] Proved reserves are about 8 billion tons.

Natural Gas.—The gas production in Poland is too small to supply the national demand.

In 1978, an additional 2.8 billion cubic meters of gas were imported from the Soviet Union. A total of 4.1 billion cubic meters of gas was imported from the U.S.S.R. in 1979. Under a 20-year agreement, Poland is to receive 2.8 billion cubic meters of natural gas per year in return for the investment made in constructing the Soyuz gas pipeline. In 1980, gas imports from the U.S.S.R. will account for half of Poland's total consumption. Poland achieved good results in gas exploration. New gasfields were discovered recently in the Carpathian foothills and some in the lowland. In 1978 considerable deposits of gas, of high calorific value, were discovered in the Leszno Region. In 1979 more than half of Poland's output of natural gas came from the Zielona Gora-Leszno Region.

Prospecting for gas will continue in 1980 mainly in the same regions (Leszno and Zielona Gora) and in the Carpathian foothills. According to Polish sources, gas reserves (proved, probable, and possible) are estimated at about 160 to 200 billion cubic meters.

Work on the 380-kilometer Polish gas pipeline between the town of Police and Odolanow (Kalisz Region) was continued in 1979 and is to be completed in March 1981.

Petroleum.—The country's refineries processed about 17 million tons of crude oil. More than 80% of the imported oil came from the U.S.S.R in 1979.

Polish oil demand is expected to be 20 million tons in 1980 and 35 million tons in 1985.[43] Almost half of the national production of oil derivatives is used in transport.

In 1979 about 800,000 tons more crude than envisaged by the long-term agreement was imported in return for Poland's contribution to the development of the Soviet oil industry. Energopol enterprise in 1978 was building a 440-kilometer pipeline from Belorussia through Latvia to Lithuania and some of its pumping stations; when this project is completed Polish workers are to start work on a new oil pipeline between Western Siberia and Belorussia. In 1980 and in 1981, the extra deliveries of crude oil will probably also be about 800,000 tons.

Oil wells in the Kamien Pomorski area (Poland's Lowlands) produced about 50% of the crude oil extraction in Poland in 1978-79.[44] Production of crude oil was also concentrated in the Krosno Region in the Carpathian Mountains, where several new oil wells were drilled. Oil deposits in this region have been exploited for 125 years and are heavily depleted. Polish effort to find new oil reserves resulted in the discovery of new oilfields; however, there are not of major importance. There is no indication that Poland's own production of crude oil will increase in the next few years. Poland's recoverable reserves of crude petroleum are estimated at 6 million tons. About 40% of these reserves occur in Poland's lowlands, 40% in the Carpathian Mountains, and about 20% in the Carpathian foothills.[45]

Poland's refinery capacity in 1978 was estimated at 18.5 million tons per year. Work on the new refinery at Blachovnia in Opol Province continued in 1979. The crude oil capacity of the first section is expected to be 3 million tons per year. The 100-millionth ton of Soviet oil transmitted by the Friendship oil pipeline was refined at Plock refinery in July 1978. Plock oil refinery processed about 13 million tons of crude oil in 1979. The complex manufactured about 100 final products. Its annual output is worth over Z60 billion. Plans are to rebuild and modernize the first cracker at the Plock complex.

The Gdansk refinery supplied the first consignment of 238,000 liters of a new engine oil named Marinol CC-30 to the home market in November 1978. It is produced for use in marine diesel engines and diesel railway locomotives.

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[1] Foreign mineral specialist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Polish zlotys (Z) to U.S. dollars at the official exchange rate of Z3.32=US$1.00 (basic rate), Z19.92=US$1.00 (special commercial rate).

[3] Tribuna Ludu (Warsaw). June 11, 1979, p. 3.

[4] Tribuna Ludu (Warsaw). Jan. 31, 1979, pp. 3-4.

[5] Tribuna Ludu (Warsaw). Dec. 3, 1979, p. 3.

[6] Maly Rocznik Statystyczny (Concise Statistical Yearbook of Poland). Warsaw, 1979, p. 89.

[7] Contemporary Poland (Warsaw). No. 17, September 1979, p. 28.

[8] Page 98 of work cited in footnote 6.

[9] Tribuna Ludu (Warsaw). Nov. 12, 1979, pp. 3-4.

[10] Polish Foreign Trade (Warsaw). April 1979, pp.1-3, 15-16.

[11] Page 29 of the work cited in footnote 7.

[12] Polish Foreign Trade (Warsaw). January 1978, p. 26.

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[13] Zycie Gospodarcze (Economic Life) (Warsaw). Aug. 5, 1979, p. 5.

[14] Polish Foreign Trade (Warsaw). January 1980, pp. 7-8.

[15] Contemporary Poland. No. 1, January 1980, pp. 24-25.

[16] Polish Coal Review, (Katowice). V. 16, Nos. 9-10, 1978, pp. 4-5.

[17] Zolniers Wolnosti (Soldier of Freedom) (Warsaw). Jan. 24, 1979, p. 4.

[18] Biuletyn Statystyczny (Statistical Bulletin) (Warsaw). March 1979, pp. 32-33.

[19] Foreign Trade Research Institute. Main Indicators of Polish Trade Development. (Warsaw), 1979, pp. 21-24.

[20] Includes the following countries: Bulgaria, Cuba, Czechoslovakia, Democratic Republic of Germany, Hungary, Mongolia, Poland, Romania, the U.S.S.R, and Vietnam.

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[22] Przeglad Geologiczny (Geological Review) (Warsaw). No. 9, 1978, pp. 542-545.

[23] Przeglad Geologiczny (Geological Review) (Warsaw). No. 8, 1978, pp. 473-479.

[24] Handel Zagraniczny (Foreign Trade) (Warsaw). No 1, January 1979 (inside back page).

[25] East-West Markets. Nov. 17, 1975, p. 11.

[26] Polska Agencja Interpress. Facts About Poland. Warsaw, 1977, Ref. Pf. VIII, 1.

[27] Foregn Trade, (Moscow). No. 10, 1979, pp. 24-26.

[28] Foreign Trade (Warsaw). No. 2. February 1979.

[29] Rudy Metale (Metal Ores) (Warsaw). No. 5, 1977, pp. 248-251.

[30] Ekonomicheskoye Sotrudnichestvo Stran Chlenov Sev (Economic Cooperation of the CMEA Member Countries), (Moscow). No. 2, 1978, pp. 54-58

[31] Inwestycje I Budownictow (Investment and Construction) (Warsaw). July-August 1978, pp. 23-26.

[32] Polish Foreign Trade (Warsaw). No. 1, January 1979, p. 44.

[33] Nitrogen. No. 22, November/December 1979, p. 12.

[34] Polish Foreign Trade (Warsaw). March 1979, pp. 19-22.

[35] Polish Foreign Trade (Warsaw). May 1976, pp. 14-22.

[36] Sulphur. No. 144, September/October 1979, pp. 17-20.

[37] Tribuna Ludu (Warsaw). Aug. 22, 1978, p. 3.

[38] Zycie Warszawy (Warsaw Life). December 1978, pp. 5 12.

[39] Page 3 of the work cited in footnote 16.

[40] Przeglad Geologiczny (Geological Review) (Warsaw). No. 10, 1978, pp. 573-578.

[41] Polish Coal Review (Katowice). V. 14, No. 1-3, 1975, pp. 4-5.

[42] Polish Coal Review (Katowice). V. 16, No. 4-5, 1978, p. 2.

[43] Tribuna Ludu (Warsaw). Sept. 8, 1978, p. 2.

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[45] Geologiya Nefti i Gasa (Oil and Gas Geology) (Moscow). No. 4, 1977, p. 60.

The Mineral Industry of Portugal

By Roman V. Sondermayer[1]

During 1978 and 1979, the Portuguese Government continued preliminary studies that were focused on expansion of the country's modest mineral industry. The Government saw expansion of the mineral industry as a means for creating jobs and improving the country's negative trade balance.

Only the production of tungsten and, to a certain extent, ornamental stone had some significance for the world economy. All other minerals and metals produced in the country were important only to the domestic economy.

Data on the contribution of Portugal's mineral industry to the total gross national product (GNP) were not readily available. However, recent studies estimated the share of the GNP contributed by the mineral industry's extractive sector alone at 0.5% to 1% of the total. Labor employed in mining was about 14,500 persons.

During 1978, major events in the mineral industry were the commissioning of a 10-million-ton-per-year petroleum refinery south of Lisbon and the acquisition of the Borralha mines by Beralt Tin of Portugal. Planning continued for development of the Moncorvo iron deposit in northern Portugal, and studies were conducted for the recovery of lead, zinc, and silver from pyrite in southern Portugal.

In 1979, the major industry event was the discovery of copper, lead, and zinc at Castro Verde in southern Portugal.

PRODUCTION

Portugal's mining industry was made up of a large number of operations (over 1,500), but about 95% of these operations employed less than 20 workers. Most of the large operations had some Government participation. Table 1 shows details of the country's mineral production for selected years.

A study of Portuguese mineral production was prepared.[2]

Table 1.—Portugal: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^{p}	1979^{e}
METALS				
Arsenic, white	278	222	200	220
Beryl concentrate, gross weight	--	--	(1)	--
Columbite and tantalite concentrates, gross weight	5	3	8	5
Copper:				
Mine output, metal content:				
Of cuprous pyrite	4,162	2,878	2,511	2,000
Of other ores and concentrates	387	331	1,101	1,000

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Table 1.—Portugal: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS —Continued				
Copper —Continued				
Mine output, metal content —Continued				
Of precipitate[e]	11	7	5	--
Total	4,560	3,216	3,617	3,000
Metal:				
Smelter, primary and secondary[e]	[r]2,800	3,300	2,800	3,000
Refined, primary	2,754	3,392	2,954	[3]3,400
Gold, mine output, metal content troy ounces	10,031	8,830	7,765	[3]10,706
Iron and steel:				
Iron ore and concentrate, gross weight:				
Hematite	2,353	715	--	--
Magnetite	29,081	21,669	18,241	20,000
Manganiferous	17,870	30,250	34,650	35,000
Total	49,304	52,634	52,891	55,000
Pig iron thousand tons	344	357	390	380
Ferroalloys:				
Ferrosilicon[e]	10,000	14,000	12,000	16,000
Silicon metal[e]	--	13,200	15,000	32,000
Ferrotungsten	284	166	163	200
Other[e]	1,667	2,286	2,178	3,800
Total	11,951	29,652	29,341	52,000
Crude steel thousand tons	463	537	577	684
Semimanufactures do	436	561	643	640
Lead metal:				
Primary	496	123	129	130
Refined (presumably including secondary)	116	241	286	[3]31
Silver, mine output, metal content troy ounces	28,325	25,753	22,505	31,000
Tin:				
Mine output, metal content	332	267	269	270
Metal	319	588	520	600
Titanium: Ilmenite concentrate, gross weight	367	229	150	180
Tungsten, mine output, metal content	1,588	1,267	1,092	[3]1,200
Uranium concentrate, U_3O_8 content	101	111	115	[3]119
NONMETALS				
Barite	90	590	503	[3]704
Cement, hydraulic thousand tons	3,713	4,296	5,200	5,200
Clays:				
Kaolin	[r]63,895	72,860	60,350	54,000
Other	85,070	105,686	110,000	100,000
Diatomite	3,150	3,390	2,976	2,700
Feldspar	13,323	15,246	17,225	26,000
Gypsum and anhydrite	[r]159,594	175,961	180,000	170,000
Lime, hydrated and quicklime thousand tons	222	227	260	270
Lithium minerals: Lepidolite	1,200	1,200	800	800
Nitrogen, N content of ammonia thousand tons	159	185	252	255
Pigments, mineral, natural: Iron oxides	40	62	[e]65	60
Pyrite and pyrrhotite (including cuprous), gross weight thousand tons	416	360	315	300
Salt:				
Rock do	306	351	325	320
Marine do	163	149	140	140
Total do	469	500	465	460
Sand and gravel:				
Sand do	5,138	6,882	6,000	NA
Gravel do	325	153	200	NA
Sodium compounds, n.e.s.:				
Sodium carbonate	114,137	129,724	131,783	130,000
Sodium sulfate	48,894	46,479	51,150	45,000
Stone:				
Calcareous:				
Dolomite thousand tons	75	93	NA	NA
Limestone, marl, calcite do	6,556	7,390	8,887	NA
Marble do	253	267	303	NA
Basalt do	78	121	NA	NA
Diorite do	12,651	4,222	NA	NA
Gabbro do	8	10	NA	NA
Granite do	3,243	3,625	6,779	NA
Graywacke do	20	20	NA	NA
Ophite do	51	74	NA	NA
Porphyry do	104	85	NA	NA

See footnotes at end of table.

Table 1.—Portugal: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Stone —Continued				
Quartz thousand tons	102	116	86	[2]125
Quartzite do	279	299	NA	NA
Schist do	134	125	NA	NA
Serpentine dc	1	1	NA	NA
Slate do	38	50	NA	NA
Syenite do	6	9	NA	NA
Talc	[r]1,505	1,610	1,380	1,360
MINERAL FUELS AND RELATED MATERIALS				
Coal: Anthracite thousand tons	193	195	182	[2]179
Coke, metallurgical do	199	206	187	180
Fuel briquets, all grades	512	381	286	280
Gas, manufactured million cubic feet	4,691	4,819	4,965	4,900
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	6,521	5,983	6,589	[2]8,700
Jet fuel do	2,945	3,076	2,827	[2]3,696
Kerosine do	565	464	640	[2]947
Distillate fuel oil do	9,287	9,296	9,647	[2]14,070
Residual fuel oil do	15,416	17,100	16,826	[2]23,348
Lubricants do	518	677	469	[2]449
Other:				
Liquefied petroleum gas dc	1,472	1,662	1,495	[2]2,045
Asphalt dc	205	315	348	[2]547
Unspecified do	2,558	2,559	1,664	[2]3,600
Refinery fuel and losses do	3,434	3,577	4,004	5,100
Total dc	42,921	44,709	44,509	62,502

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.
[1]Less than 1/2 unit.
[2]Reported figure.

TRADE

Portugal was a net importer of minerals, and fuels were its most expensive imports. Portugal had a negative trade balance in minerals with the United States. Tables 2 and 3 show details of this trade and Portugal's trade with other countries.

Table 2.—Portugal: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum metal including alloys, all forms	2,716	2,921	Spain 2,589; France 134; West Germany 120.
Arsenic trioxide, pentoxide, acids	29	--	
Cobalt oxide and hydroxide	--	9	Belgium-Luxembourg 5; Spain 4.
Columbium and tantalum: Tantalum ore and concentrate	3	9	Japan 4; Netherlands 4; West Germany 1.
Copper:			
Ore and concentrate	--	100	All to Sweden.
Copper sulfate	153	--	
Metal including alloys, all forms	1,072	1,711	Turkey 511; United States 456; Belgium-Luxembourg 221.
Gold waste and sweepings troy ounces	926,262	61,954	All to West Germany.
Iron and steel:			
Ore and concentrate, including roasted pyrite:			
Roasted pyrite	14,555	14,689	Do.
Other	6	--	
Metal:			
Scrap	4,166	9,716	Spain 7,568; Netherlands 1,700; France 208.
Pig iron, ferroalloys, similar materials	64,273	103,716	United States 36,183; China, mainland, 12,401; Italy 10,915.

See footnotes at end of table.

Table 2.—Portugal: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Semimanufactures:			
Bars, rods, angles, shapes, sections	3,843	3,797	Egypt 2,033; Nigeria 500; Cape Verde [illegible]
Universals, plates, sheets	12,534	10,690	Romania 5,981; India 2,377; Switzerland 1,741.
Hoop and strip	151	312	Morocco 259; Angola 44.
Rails and accessories	13	264	Pakistan 135; Venezuela 110.
Wire	156	172	Guinea-Bissau 101; Malta 25; Spain 17.
Tubes, pipes, fittings	7,212	5,215	Spain 1,020; Italy 738; West Germany 574.
Castings and forgings, rough	7,042	7,105	United States 2,690; United Kingdom 2,487; Sweden 950.
Total	30,951	27,555	
Lead:			
Ore and concentrate	140	740	All to Belgium-Luxembourg.
Oxides	8	5	Mozambique 3; Angola 2.
Metal including alloys, all forms	33	621	Italy 502; United Kingdom 104.
Manganese:			
Ore and concentrate	4,993	4,000	All to Canada.
Oxides	90	70	All to Angola.
Nickel metal including alloys, all forms	22	69	Netherlands 28; United Kingdom 28.
Platinum-group metals and silver:			
Waste and sweepings _ thousand troy ounces	1,061	547	Belgium-Luxembourg 539; United Kingdom 7.
Metals including alloys:			
Platinum-group troy ounces	2,141	1,727	France 1,266; United Kingdom 460.
Silver do	215	354	Mozambique 161; São Tomé and Principe 129; Italy 64.
Tin metal including alloys, all forms	37	5	Angola 2; United Kingdom 2.
Tungsten ore and concentrate	1,555	1,617	United Kingdom 822; West Germany [illegible]; France 239.
Zinc:			
Oxide	3,732	3,270	West Germany 1,563; Republic of South Africa 1,397.
Metal including alloys, all forms	81	133	NA.
Other:			
Ores and concentrates	200	463	Belgium-Luxembourg 340; West Germany 75; Japan 47.
Ash and residue containing nonferrous metals	64,237	46,709	West Germany 45,884; Republic of South Africa 476.
Oxides, hydroxides, peroxides of metals	--	10	All to Norway.
Base metals including alloys, all forms	8,978	1,336	West Germany 850; United Kingdom [illegible]; United States 100.
NONMETALS			
Abrasives, natural, n.e.s	12,640	70,239	United Kingdom 61,049; Denmark 5,221; Norway 3,968.
Asbestos	1	118	All to Spain.
Barite and witherite	1,000	3	All to Angola.
Cement	37,610	5,174	United Kingdom 3,200; Gibraltar 1,742; Cape Verde 213.
Chalk	30	91	Angola 56; Cape Verde 19; Mozambique 12.
Clays and clay products (including all refractory brick):			
Crude:			
Kaolin	--	36	Angola 32; Italy 4.
Other	734	2,007	Mozambique 1,260; Spain 713; Italy 27.
Products:			
Refractory (including nonclay brick)	2,088	664	France 336; Spain 227; Mozambique [illegible]
Nonrefractory	8,694	8,467	United Kingdom 1,881; Spain 1,677; Cape Verde 1,122.
Diamond:			
Gem, not set or strung thousand carats	228	58	Switzerland 36; United Kingdom 19; Belgium-Luxembourg 3.
Industrial do	30	--	
Diatomite and other infusorial earth	1,189	1,213	Morocco 1,200; Venezuela 10; Angola [illegible]
Feldspar, leucite, nepheline, etc	3,931	2,148	German Democratic Republic [illegible]; West Germany 66.
Fertilizer materials:			
Natural and manufactured:			
Nitrogenous	148,247	148,833	West Germany 51,671; Belgium-Luxembourg 39,338.
Phosphatic	83,396	71,840	Brazil 50,500; France 14,040; United Kingdom 7,200.

See footnotes at end of table.

Table 2.—Portugal: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Fertilizer materials —Continued			
Natural and manufactured —Continued			
Potassic	3,699	1,315	Morocco 1,300; Cape Verde 15.
Other, including mixed	34,472	61,365	Netherlands 32,038; Belgium-Luxembourg 11,600; Sri Lanka 7,500.
Ammonia	31,299	14,091	Spain 10,442; United Kingdom 1,963; Lebanon 1,683.
Graphite, natural	23	90	Mainly to Spain.
Gypsum and plasters	68	64	Mozambique 30; Cape Verde 25; Guinea-Bissau 7.
Lime	705	389	São Tomé and Principe 180; Cape Verde 89; Mozambique 55.
Mica, all forms	188	414	All to United Kingdom.
Pigments, mineral:			
Natural, crude	49	--	
Iron oxides, processed	17	51	United Kingdom 18; Cape Verde 15; Guinea-Bissau 11.
Pyrite, gross weight	782	135	Netherlands 100; France 17; Belgium-Luxembourg 9.
Salt	23,431	4,083	Zaire 3,570; Congo 450; West Germany 44.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	41	70	Guinea-Bissau 43; São Tomé and Principe 26.
Caustic potash and potassic peroxides	1	(1)	All to Cape Verde.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous	102,428	111,246	Spain 38,275; Italy 30,627; West Germany 14,649.
Slate	9,970	8,037	Netherlands 3,199; West Germany 2,017.
Granite and other	25,166	21,311	Japan 12,362; Italy 7,613; Netherlands 453.
Worked:			
Slate	5,082	6,745	Belgium-Luxembourg 3,528; West Germany 1,672.
Paving stone and flagstone	86,858	102,868	West Germany 56,694; Denmark 15,790; United Kingdom 10,455.
Marble and other	40,130	40,978	West Germany 15,241; United Kingdom 7,554; France 4,901.
Dolomite, chiefly refractory grade	1	--	
Gravel and crushed rock	3,448	600	France 163; Mozambique 160; Italy 120.
Limestone, except dimension	31	233	Mozambique 154; São Tomé and Principe 60; Cape Verde 19.
Quartz and quartzite	36,804	7,938	Norway 4,000; France 1,781; West Germany 1,158.
Sand, excluding metal bearing	12,144	13,862	Gibraltar 13,200; Panama 500.
Sulfur:			
Elemental, all forms	64	92	All to France.
Sulfuric acid	82	335	Angola 140; Cape Verde 118; Zaire 50.
Talc, steatite, soapstone, pyrophyllite	63	127	Angola 86; Mozambique 41.
Other:			
Crude	451	208	Spain 138; Guinea-Bissau 42; Mozambique 24.
Slag, dross, and similar waste, not metal bearing, from iron and steel manufacture	4,524	2,140	France 2,125; West Germany 15.
Oxides and hydroxides of magnesium, strontium, barium	1	--	
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	1,062	1,765	Cape Verde 1,080; São Tomé and Principe 423; Spain 130.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1	9	Angola 6; Guinea-Bissau 3.
Carbon black	(1)	3	Guinea-Bissau 2; Mozambique 1.
Coal, all grades	28	18	Angola 11; Guinea-Bissau 5; Cape Verde 2.
Coke and semicoke	--	24	Angola 22; Cape Verde 2.
Hydrogen and rare gases	(1)	20	Spain 17; São Tomé and Principe 2.
Petroleum refinery products:			
Bunker deliveries:			
Gasoline, aviation thousand 42-gallon barrels	1	(1)	NA.
Kerosine do	(1)	(1)	NA.
Jet fuel do	1,327	1,217	NA.
Distillate fuel oil do	7	8	NA.
Residual fuel oil do	343	1,171	NA.
Lubricants do	27	65	NA.

See footnotes at end of table.

Table 2.—Portugal: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum refinery products —Continued			
Bunker deliveries —Continued			
Unspecified _ thousand 42-gallon barrels	174	234	NA.
Total do	1,879	2,695	
Nonbunker deliveries:			
Gasoline:			
Aviation do	1	--	
Motor do	36	78	Iceland 60; Cape Verde 13; Guinea-Bissau 5.
Kerosine do	16	22	Guinea-Bissau 19; Cape Verde 3.
Jet fuel do	(1)	--	
Lubricants do	158	54	United Kingdom 17; Belgium-Luxembourg 11; Greece 11.
Other:			
Liquefied petroleum gas do	2	6	Cape Verde 5; São Tomé and Principe 1.
Mineral jelly and wax do	14	1	NA.
Unspecified do	190	118	Sweden 115.
Total do	417	279	
Grand total do	2,296	2,974	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	20	15	São Tomé and Principe 8; Cape Verde 5.

NA Not available.
[1] Less than 1/2 unit.

Table 3.—Portugal: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate	1,074	2,191	Denmark 2,170; Spain 21.
Metal including alloys, all forms:			
Scrap	586	91	Norway 34; West Germany 22; France 8.
Unwrought	12,050	20,222	Norway 4,587; France 4,488; Canada 4,377; Spain 2,242.
Semimanufactures	21,514	15,855	Belgium-Luxembourg 2,585; France 2,314; Austria 2,180.
Arsenic metal	--	8	All from France.
Beryllium: Beryl ore and concentrate	42	10,788	Republic of South Africa 10,500; Netherlands 93; Australia 71; Spain 66.
Chromium:			
Chromite	317	692	Republic of South Africa 311; Netherlands 126.
Oxide and hydroxide	264	237	West Germany 210; Netherlands 14; United Kingdom 8.
Cobalt oxide and hydroxide	23	6	Belgium-Luxembourg 4; United Kingdom 1.
Columbium and tantalum: Columbite ore and concentrate	--	14,999	All from Republic of South Africa.
Copper:			
Ore	805	6,248	Ghana 5,207; Mauritania 800; Australia 162.
Copper sulfate solution	35	(1)	Mainly from West Germany.
Metal including alloys:			
Scrap	768	826	Spain 196; United Kingdom 176; United States 117; Gibraltar 107; Senegal 48.
Unwrought:			
Blister	3,400	985	Sweden 750; United Kingdom 234.
Refined, unalloyed	13,952	13,525	Belgium-Luxembourg 3,219; Canada 2,940; France 2,867; Chile 1,274.
Other	2,150	2,538	Spain 1,508; United Kingdom 960; Italy 20; Netherlands 20.
Semimanufactures	10,029	10,427	United Kingdom 2,596; Italy 2,569; West Germany 1,298.
Gold metal, unworked or partly worked troy ounces	11,761	6,230	Belgium-Luxembourg 5,103; Switzerland 1,077.

See footnotes at end of table.

Table 3.—Portugal: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Iron and steel:			
Ore and concentrate	447,360	386,182	Mauritania 126,633; Venezuela 97,185; Brazil 70,145; Canada 48,378.
Metal:			
Scrap	95,329	663,603	United Kingdom 549,787; United States 40,718; Netherlands 28,133.
Pig iron, ferroalloys, similar materials	28,140	37,127	Spain 31,312; Netherlands 2,305; Canada 860; United Kingdom 807.
Steel, primary forms	211,184	232,305	Japan 96,333; West Germany 38,515; Netherlands 33,579.
Semimanufactures:			
Bars, rods, angles, shapes, sections	180,252	139,032	Spain 31,574; West Germany 26,351; Belgium-Luxembourg 16,107.
Universals, plates, sheets	235,925	223,923	West Germany 70,863; Japan 38,393; Belgium-Luxembourg 30,664.
Hoop and strip	70,418	73,229	Belgium-Luxembourg 35,815; France 16,454; West Germany 15,711.
Rails and accessories	12,673	13,107	United Kingdom 6,580; Austria 3,030; France 1,647.
Wire	3,868	27,830	Spain 10,625; United Kingdom 3,525; West Germany 3,163.
Tubes, pipes, fittings	32,038	37,276	West Germany 10,818; France 10,427; United Kingdom 8,297.
Castings and forgings, rough	2,327	35,001	United Kingdom 34,480; West Germany 189; Switzerland 134.
Total	537,501	549,488	
Lead:			
Oxides	3	114	Mainly from United Kingdom.
Metal including alloys:			
Scrap	51	82	Gibraltar 74; Guinea-Bissau 7.
Unwrought	12,348	16,622	United Kingdom 13,838; Sweden 2,000; Belgium-Luxembourg 265; Bulgaria 150.
Semimanufactures	81	49	France 27; West Germany 13.
Magnesium metal including alloys, all forms	7	8	Austria 3; Netherlands 2; Switzerland 2.
Manganese:			
Ore and concentrate	201,054	144,616	Republic of South Africa 79,031; Ghana 21,974; Gabon 15,231; Congo 15,174.
Metal including alloys, all forms	668	1,001	United Kingdom 363; Belgium-Luxembourg 360; Ireland 119.
Mercury 76-pound flasks	815	1,007	Mainly from Spain.
Molybdenum metal including alloys, all forms kilograms	1,000	4,400	Italy 1,800; Netherlands 1,200; United Kingdom 800; United States 500; Spain 100.
Nickel metal including alloys:			
Scrap	11	11	United Kingdom 4.
Unwrought	180	233	United Kingdom 198; West Germany 13; Finland 7; Canada 6.
Semimanufactures	655	468	United Kingdom 157; West Germany 156; Finland 59; France 30.
Platinum-group and silver metals including alloys:			
Platinum-group troy ounces	6,052	5,985	France 2,745; United Kingdom 1,547; Switzerland 752; West Germany 531; United States 409.
Silver thousand troy ounces	1,224	1,310	West Germany 1,145; United Kingdom 63; France 53; Switzerland 43.
Rare-earth metals oxides	10	18	France 12; United Kingdom 5.
Tin:			
Ore and concentrate	419	332	Indonesia 222; Singapore 60; Belgium-Luxembourg 30; Finland 20.
Oxides	53	--	
Metal including alloys:			
Scrap	1	10	United Kingdom 8.
Unwrought	479	464	Netherlands 220; Belgium-Luxembourg 200; United Kingdom 41.
Semimanufactures	40	39	Netherlands 17; United Kingdom 14.
Titanium:			
Rutile ore and concentrate	523	476	Australia 455; West Germany 15; United Kingdom 6.
Oxides	7,510	7,794	United Kingdom 1,492; Finland 1,321; West Germany 1,179; France 1,178; Italy 464.
Tungsten metal including alloys, all forms kilograms	500	400	United Kingdom 200; West Germany 100.
Zinc:			
Ore and concentrate	--	22	Spain 20; United Kingdom 2.

See footnotes at end of table.

Table 3.—Portugal: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Zinc —Continued			
Oxide	157	100	West Germany 59; United Kingdom 22; Italy 10.
Metal including alloys:			
Scrap	106	98	Australia 50; United Kingdom 41; Gibraltar 7.
Blue powder	376	545	United Kingdom 321; Norway 184; Belgium-Luxembourg 40.
Unwrought	15,218	17,139	Netherlands 4,418; Belgium-Luxembourg 4,015; France 3,593; Canada 2,222.
Semimanufactures	1,548	1,228	Belgium-Luxembourg 590; West Germany 330; United Kingdom 129; Netherlands 90; Spain 41.
Other:			
Ores and concentrates:			
Of titanium, vanadium, zirconium	1,064	886	Australia 501; United Kingdom 289; Spain 66; Netherlands 20.
Of base metals, n.e.s	85	20	Mainly from Spain.
Oxides, hydroxides, peroxides of metals	2,754	1,938	United Kingdom 1,057; Spain 510; West Germany 170.
Metals including alloys, all forms:			
Metalloids	78	44	Mainly from Spain.
Alkali, alkaline-earth, rare-earth metals kilograms	300	600	West Germany 500; United Kingdom 100.
Pyrophoric alloys	3	--	
Base metals including alloys, all forms, n.e.s.	198	147	China, mainland, 68; Belgium-Luxembourg 37; United Kingdom 39; West Germany 3.
NONMETALS			
Abrasives:			
Natural, n.e.s.:			
Pumice, emery, natural corundum, etc	361	372	Netherlands 148; Denmark 69; Italy 51; West Germany 35.
Dust and powder of precious and semiprecious stones, including diamond kilograms	96	286	Mainly from United Kingdom.
Grinding and polishing wheels and stones	432	563	Italy 205; United Kingdom 80; West Germany 62; Spain 54; Austria 40.
Artificial corundum	986	1,384	West Germany 482; Netherlands 384; France 291; Spain 160.
Asbestos	18,774	17,111	Canada 6,402; Republic of South Africa 6,210; West Germany 1,089; U.S.S.R. 1,598; Australia 646.
Barite and witherite	413	458	West Germany 305; France 93; Spain 56.
Boron materials:			
Crude natural borates	4,410	2,450	Turkey 1,250; United States 1,000; Spain 200.
Oxide and acid	481	451	France 369; Belgium-Luxembourg 36; Turkey 30; Spain 15.
Cement	147,896	64,281	Spain 56,129; United Kingdom 8,000.
Chalk	9,063	7,806	Spain 3,029; France 2,587; Belgium-Luxembourg 1,062; United Kingdom 993.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	21,274	22,991	Spain 20,756; Italy 778; United States 368; France 345; Mozambique 299.
Kaolin	9,334	10,354	United Kingdom 6,409; Spain 2,087; France 1,521; United States 301.
Other	6,630	10,460	Spain 4,136; United Kingdom 2,972; France 1,706; West Germany 1,196.
Products:			
Refractory (including nonclay brick)	10,263	10,872	West Germany 4,544; Austria 1,090; France 1,041; Italy 1,086.
Nonrefractory	563	402	Spain 296; Italy 87; West Germany 12.
Cryolite and chiolite	60	94	Denmark 70; Spain 24.
Diamond, except powder and dust:			
Gem, not set or strung thousand carats	32	90	Switzerland 81; United Kingdom 7.
Industrial do	1	1	All from Netherlands, Belgium-Luxembourg, and Republic of South Africa.
Unclassified do	68	--	
Diatomite and other infusorial earth	3,786	3,534	Spain 2,119; United States 644; France 523; West Germany 206.
Feldspar, leucite, nepheline, etc	2,142	2,691	France 1,172; Spain 1,063; United Kingdom 425; West Germany 22.

See footnotes at end of table.

Table 3.—Portugal: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Fertilizer materials:			
Crude:			
Nitrogenous	417	1,500	All from Chile.
Phosphatic	349,717	389,748	Morocco 379,448; Senegal 10,300.
Manufactured:			
Nitrogenous	9,443	17,071	Czechoslovakia 3,896; Yugoslavia 3,641; United Kingdom 2,616; West Germany 2,292; Spain 2,093.
Phosphatic	6,690	1,256	All from France.
Potassic	79,765	72,983	Spain 55,572; German Democratic Republic 6,700; U.S.S.R. 5,460.
Other, including mixed	17,269	701	Belgium-Luxembourg 306; West Germany 287; Spain 46.
Graphite, natural	270	294	United Kingdom 189; Italy 36; Sri Lanka 25; West Germany 24.
Gypsum and plasters	26,343	31,771	Spain 17,075; Moroccc 14,240; France 402; West Germany 44.
Iodine	6	3	All from Japan.
Lime, hydraulic	7	3	France 2; Belgium-Luxembourg 1.
Magnesite	919	2,476	United Kingdom 870; Spain 869; Netherlands 468.
Mica:			
Crude, including splittings and waste	393	399	Norway 311; United Kingdom 38; France 30; Spain 20.
Worked, including agglomerated splittings	21	24	France 6; West Germany 4; Spain 4; Switzerland 4.
Pigments, mineral:			
Natural, crude	91	28	United Kingdom 15; Spain 10.
Iron oxides, processed	2,198	2,286	West Germany 1,549; Spain 444; Netherlands 157.
Salt and brines	22,111	92,812	Spain 59,902; Italy 32,830; United Kingdom 34.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	2,726	13,993	Spain 13,865; West Germany 36; France 29; Sweden 25.
Caustic potash and sodic and potassic peroxides	573	367	Italy 229; West Germany 69; France 35; Spain 22.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	87	25	All from Spain.
Worked	110	40	Belgium-Luxembourg 30; Italy 6; France 3.
Dolomite, chiefly refractory grade	5,586	5,410	Italy 1,459; France 1,449; Spain 1,174; Norway 894; Belgium-Luxembourg 368.
Gravel and crushed rock	35	69	France 30; West Germany 22; Belgium-Luxembourg 15.
Quartz and quartzite	179	210	Sweden 116; Belgium-Luxembourg 68; West Germany 17.
Sand, excluding metal bearing	8,439	8,225	Spain 6,220; Belgium-Luxembourg 1,622; France 108; Sweden 102.
Sulfur:			
Elemental:			
Other than colloidal	30,943	43,524	France 41,013; West Germany 1,514; Spain 997.
Colloidal	3	1	Mainly from United Kingdom.
Sulfur dioxide	260	--	
Sulfuric acid	79,071	161,765	United Kingdom 49,451; West Germany 35,130; Finland 24,289; Norway 15,354; Netherlands 14,621.
Talc, steatite, soapstone, pyrophyllite	3,459	4,144	France 2,158; Norway 584; United States 320; Austria 260; West Germany 239; Belgium-Luxembourg 195.
Other:			
Crude:			
Meerschaum, amber, jet	5	3	United Kingdom 2; Netherlands 1.
Other	307	498	China, mainland, 200; Republic of South Africa 196; Spain 40; United Kingdom 27; Finland 20.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	10,969	25,420	Spain 20,960; France 4,000; United Kingdom 423; Belgium-Luxembourg 37.
Slag and ash, n.e.s	1	--	
Oxides and hydroxides of magnesium, strontium, barium	4,629	69	France 32; United States 17; Italy 15; United Kingdom 4.
Bromine and other halogens (excluding iodine)	11	44	Spain 22; Japan 20.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	516	463	Spain 295; France 108; United Kingdom 39.

See footnotes at end of table.

Table 3.—Portugal: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,181	1,772	West Germany 790; Netherlands 640; Belgium-Luxembourg 200.
Carbon black and gas carbon:			
Carbon black	9,967	10,028	France 4,561; Spain 3,904; West Germany 522; United Kingdom 414; United States 220; Italy 140.
Gas carbon	35	--	
Coal, all grades, including briquets thousand tons	406	435	United States 262; Poland 142; Belgium-Luxembourg 6; France 8.
Coke and semicoke do	90	108	United Kingdom 44; West Germany 27; Netherlands 21.
Hydrogen and rare gases do	9	1	Mainly from Belgium-Luxembourg and France.
Peat, including peat briquets and litter	689	554	Finland 189; West Germany 162; Sweden 98; Netherlands 24.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	43,942	47,572	Iraq 18,862; Saudi Arabia 11,307; Iran 10,622; U.S.S.R. 5,870.
Refinery products:			
Gasoline:			
Aviation do	8	4	Netherlands 2; Italy 1.
Motor do	16	91	Israel 34; France 26; Netherlands 17; Spain 9.
Kerosine and jet fuel do	126	185	Italy 57; France 43; Netherlands Antilles 42; Netherlands 17.
Distillate fuel oil do	820	1,453	Spain 291; France 285; Italy 219; United Kingdom 204; Venezuela 138.
Residual fuel oil do	1,410	1,236	Netherlands Antilles 255; Spain 225; Italy 215; Mozambique 134.
Lubricants do	75	212	Netherlands 71; France 50; United Kingdom 46; Spain 19; Italy 14.
Other:			
Liquefied petroleum gas do	3,111	4,068	United Kingdom 1,940; France 561; Italy 450; Netherlands 410; Belgium-Luxembourg 187; Venezuela 157.
Mineral jelly and wax do	20	15	West Germany 5; Netherlands 2; Spain 2; United Kingdom 2; Japan 1.
White spirit do	9	6	Mainly from Belgium-Luxembourg.
Petroleum coke do	27	70	United States 38; Spain 21; United Kingdom 10; Netherlands 1.
Bitumen and other residues do	318	429	Spain 340; United Kingdom 36; Netherlands 31; Netherlands Antilles 14.
Bituminous mixtures, n.e.s do	23	39	Spain 22; United Kingdom 14.
Unspecified do	86	103	Belgium-Luxembourg 27; France 22; Netherlands 17; Italy 16; United Kingdom 7; Spain 6.
Total do	6,049	7,911	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	12,560	11,802	Netherlands 4,185; Spain 3,121; France 1,703; Italy 1,540.

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Copper.—During 1978 and 1979, encouraging results from exploratory efforts were reported at a site near Castro Verde in the Neves Corvo area. Drilling activities were conducted by a group consisting of the Bureau de Recherches Géologiques et Minières of France, the French mining company Penarroya, and the Portuguese Government-owned Santiago Mining Co. The group reported the discovery of a new, complex lead-zinc-copper deposit with a high copper content. The extent of the metal reserves, however, was not made public. The area under investigation is part of the Iberic complex sulfide ore belt. (See also the section, Lead and Zinc, of this chapter.)

Iron and Steel.—During 1978, Portugal continued to plan a two-phase expansion of its steel industry. The first phase, scheduled to be completed in 1981, called for expansion of Portugal's only primary steel plant, the 700,000-ton-per-year plant at Seixal near Lisbon. It was anticipated that the addition of a 120-ton LD converter would enable the plant to increase its output to 1 million tons per year. The second phase, scheduled for completion in 1985, called for the construction of a new integrated steel plant at Sines, further south, with a capacity of 1.8 million tons annually. The new plant was expected to have one 160-ton LD converter.

During 1979, Portuguese authorities decided to go ahead with a semis plant at Seixal, but postponed construction of the integrated steel plant at Sines and the expansion project at Seixal. These decisions were made under pressure from the European Economic Community (EEC) commission that was examining Portugal's application for EEC membership. The EEC expects new members to shelve or cut plans that do not conform to the EEC policy of modernization without expansion.

At yearend 1979, Luossavaara-Kirunavaara AB (LKAB), the Swedish iron mining company, was near completion of a feasibility study on the production of ores from the Moncorvo deposit. Based on recent reports, the Moncorvo deposit, at latitude 41°12'28N and longitude 7°10'29W, is located north of the Douro River in northeast Portugal, in hills about 800 meters above sea level. Situated 13 miles from the Spanish frontier, east of the city of Torre Moncorvo, these iron-bearing bodies of Ordovician age, strike east-northeast and dip gently south. Several north-south faults divide the deposit into separate ore bodies. The thickness of the formations varies up to 150 meters. The footwalls are schists, quartzites, and graywackes lying on a basal intrusive granite. The overlying rocks are fossil-bearing schists and limestone. Over these rocks, in turn, lie Tertiary and recent clays, gravels, and alluvial deposits. The Moncorvo deposit is connected by 14 miles of meter-gauge railroad track to Pocinho on the Douro River; and Pocinho is connected by 118 miles of standard-gauge track to Leixoes, a port on the Atlantic Coast near Oporto. The ore reserves at Moncorvo were reported at 500 million tons, with an average content of 37% iron and 0.58% phosphorus.

Lead and Zinc.—During 1978 and 1979, exploration near Castro Verdo (see also the section on copper in this chapter) resulted in the reported discovery of lead-zinc ore. Reports indicated a 6% content of metal in the ores, and most of this content was zinc.

Discovery of this complex sulfide deposit may lead to significant output of lead, zinc and copper in Portugal, providing further exploration is successful and capital for development of a mine is available.

Pyrite.—Implementation of a Government program known as Total Utilization of Pyrite had a slow start in 1978; and in 1979, the slow pace continued. The management of the pyrite mine at Aljustrel started expansion of its mining and milling facilities for complex sulfide ores containing pyrite and nonferrous metals, located near Aljustrel in Alentejo Province. Plans called for production to rise from 300,000 tons to 1.2 million tons per year. The expansion was being supported by the Swedish Government through the engineering subsidiary of LKAB International AB, which was the coordinating consultant for the operation. Boliden Metall AB, Sala International AB, and LKAB from Sweden; and Outokumpu Oy from Finland were contracted to supply know-how and equipment. The metallurgical part of the program—at yearend still in the preliminary phase of studies—called for recovery of nonferrous metals from cinder, pelletization of cinder, and use of cinder in national steel plants as a source of iron. Portugal's reserves of complex sulfide ore are mostly located near Aljustrel and were estimated at 240 million tons, of which 40 million were proven. The average grade of this ore was reported as follows: sulfur 41% to 46%, iron 39%, lead 0.9% to 1.2%, and zinc 2.2% to 3%. Two deposits were in operation during 1979; they were Aljustrel (80 kilometers east of Sines) and Lousa Caveira (36 kilometers north of Aljustrel).

Silicon.—Portugal was planning to increase its silicon output to over 70,000 tons per year by 1981, including projected increases by Milnorte S.A.R.L. and Fornos Electricos totalling about 32,000 tons. Most of the new production was expected to be exported.

Tungsten.—During the summer of 1978, Beralt Tin & Wolfram (48.2% owned by Charter Consolidated) announced that its Portuguese operating company, Beralt Tin & Wolfram (Portugal) S.A.R.L., was planning to acquire, at a cost of about $3.6 million, French interests in a tungsten mining company, Mines de Borralha. Mines at Borralha are located some 300 miles north of Beralt's existing operations at Panasqueira. In December, a new company, Minas de Borralha S.A.R.L., was incorporated, with capital of 100 million escudos (44 escudos = US$1.00), divided in 100,000 shares. Of these shares, 80,500 were owned by Beralt Tin & Wolfram (Portugal) S.A.R.L., and the other 19,500 shares were held by Sociedade Portuguesa Empreenimentos S.A.R.L.

The Borralha deposit was discovered at the end of the last century, and peak output was achieved in 1956 when over 370 tons of a ferrotungsten product was produced. A recently completed incline to the 160-meter level had a total daily hoisting capacity of 380 tons of ore and was expected to increase output of concentrates to 30 tons per month. The mine's two electric-arc ferrotungsten furnaces were capable of processing 50 tons per month of concentrates. The product is 82% WO_3 ferrotungsten, which is crushed for shipping. Exploratory work by Union Carbide continued in the Covas scheelite zone near Viana do Costelo; and in the area of Tabucao, the Belgian company Geomines, in association with a Portuguese partner, was also prospecting for scheelite. Results were promising at both locations during 1978 and 1979, but details were not available.

Other Metals.—Tin was produced in eight mines. The Montesinho, Seixoso, and Argozelo mines had the largest reserves of tin in the country (about 82% of the total); these reserves averaged 1.05 to 1.36 kilograms of tin per ton of ore. Output continued to decline during 1978, but leveled off in 1979. Gold was produced in one mine, Couto Mineiro, in Jales, near Vila Pouca de Aguiar.

NONMETALS

Cement.—Cement remained among the most important of the nonmetals produced in the country. Ten cement plants operated by three companies were in production during 1978 and 1979. The largest company was Cementos de Portugal (CIMPOR), and its 1.9-million-ton-per-year plant at Alhandra, near Lisbon, was the largest in the country.

Clays.—*Kaolin.*—Plans to increase output of kaolin in Portugal were under consideration. In Alvares, the Jeronimo Pereira Co. planned to increase production to 50,000 tons per year and possibly to 100,000 tons. The most important kaolin deposits are located in Rio Major, Alvaraes (Viana do Costelo), and Senhora do Hora (Porto).

Stone.—Portugal produced a variety of stones in areas around Vila-Vicosa-Borba-Estremos, east of Lisbon. Processing of Portuguese stone was done abroad. During 1978, however, the possibility of starting a modern stone cutting industry was examined, but no major decisions had been announced by yearend 1979.

MINERAL FUELS

Coal, mostly anthracite, remained the principal fuel produced in the country during 1978 and 1979. However, the energy demands of Portugal were almost completely satisfied by imports of liquid hydrocarbons (which were the bulk of imported fuels), high-rank coal, and coke.

Coal.—During 1978 and 1979, there was one coal mine in operation. The Pejao mine, located near Oporto in northern Portugal, was owned by the Empresa Carbonifera do Douro. It produced annually about 200,000 tons of anthracite. The nearby thermal powerplant, Central Termica da Tapada do Outeiro, consumed most of the output.

Petroleum and Natural Gas.—Portugal was not counted among the producers of petroleum and natural gas. Imports of crude oil, some petroleum refinery products, and liquefied gas were essential to meet the country's demand. Principal suppliers of crude oil were Iran, Iraq, and Saudi Arabia.

A third Portuguese refinery, located at Sines, south of Lisbon, and operated by Government-owned Petrogal, started production in the fall of 1978. This refinery was expected to initially operate at a rate of 6 million tons of crude oil per year. Later, production may be increased to 10 million tons. The Government had approved construction in 1971, and site preparation was underway in 1973. In 1974, Technik-Procofrance won the main contract for Sines. In addition to refineries, jetties for 500,000-deadweight-tonnage-tankers and 250,000-deadweight-tonnage-tankers were also completed.

At an input rate of 10 million tons per year of crude oil, annual refinery output was anticipated as follows, in tons: Sulfur 34,000, fuel gas 65,000, propane 180,400, butane 345,900, isopentane 117,500, light gasoline 118,600, chemical naphtha 623,400, platformate 952,900, kerosine 209,900, desulfurized kerosine 648,000, light gas oil 913,400, desulfurized gas oil 1,380,700, desulfurized vacuum gas oil 700,000, asphalt 128,500, pitch 416,000, and residue 3,300,000.

Uranium.—Uranium activities in Portugal were carried out by the Government through the Nuclear Energy Commission (Junta de Energia Nuclear). Mines were in operation at Urgeirica and Guarda, in central Portugal. The aggregate capacity of these installations was reported at 180 tons of U_3O_8. In addition, resources at Nisa, in upper Alentejo Province, were mentioned as the site designated for future mining. Total reserves and resources of U_3O_8 were reported at 30,000 tons of U_3O_8. During 1979, Portugal's National Uranium Co. started work on opening several deposits in known zones of mineralization. Reserves of these deposits reportedly amount to 700 tons of uranium.

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[1] Physical scientist, Branch of Foreign Data.

[2] American Embassy, Lisbon. Study of Portuguese Mining Industry. State Department Airgram A-124, June 21, 1978, 94 pp.

Free Public Library, Newark, N. J.

The Mineral Industry of Southern Rhodesia

By Janice L. W. Jolly[1]

Rhodesia's mineral industry was anticipating a renewed opportunity for growth by yearend 1979. In May 1979, Zimbabwe-Rhodesia came into existence with the newly elected government of Bishop Muzorewa. By December 1979, the Muzorewa government agreed to step down and two months were to be spent by all parties campaigning for a new election. Following this agreement, sanctions against Rhodesia were dropped first by Britain, Australia, and the United States, and later by the United Nations. Lifting of the trade embargo was not expected to have an immediate significant effect owing to a lack of adequate transportation facilities in addition to a continued depressed investor confidence, although all sectors, and especially mining and agriculture, were expected to eventually benefit. The removal of sanctions also meant that the nation must resume servicing its external sterling debt, on which the accumulated interest payments since 1965 totaled $225 million;[2] the country remitted $75 million to $90 million annually in dividends for the first time in 15 years.

The main economic constraints for 1978 and 1979 continued to be international sanctions and the local conflict, which at more than $1.6 million per day was costing some 40% of the national budget. The gross domestic product (GDP) for 1978 was estimated at $3.3 billion. Rhodesia's GDP had a near zero real growth for 1979, but with end of sanctions, a 3% growth in real GDP was anticipated for 1980. The war had been the principal cause of economic distress; together with slack export market and prices, the war caused the economy to shrink by almost 5% per year over the past 4 years. This contrasted with the first 10 years following the Unilateral Declaration of Independence (UDI) when the economy grew at an annual rate of almost 8%.

Because of sanctions and the closed economy that followed, Rhodesia was producing many things that probably would not be competitive to those produced by modern machinery elsewhere in the world. With prospects of increased foreign competition, some local businessmen were now seeking antidumping legislation and import controls. Soon after sanctions were imposed, overseas suppliers ceased exporting mining equipment to Rhodesia. In order to expand, the mining industry looked to local engineers both for new projects and mines and for replacement equipment. The result was a wide range of materials and equipment now being manufactured locally, including such heavy mining equipment as locomotives, hoists, crushing and grinding mills, and concentrating plant equipment. One company estimated about a $500,000-per-year foreign exchange savings solely through production of steel wire ropes for scrapers and rope haulages used in both surface and underground mining.

Faced with mounting economic problems, Rhodesia devalued its dollar approximately 8% against most major currencies and about 5% against the South African rand in April 1978. It was the second devaluation in about 6 months. While a growth in sales and corporate income tax was expected, revenues from individual income taxes would decline, reflecting an increased emigration, which in 1978 was officially about 1,000 per month. In 1978, the Government introduced a 12.5% personal income tax surcharge as a defense "loan."

Employment in mining and quarrying declined about 3,000 during 1978, or by almost 5%, because of cutbacks in nickel and chromite production and security restrictions. The number of Rhodesian workers in South African gold mines was dropping and was expected to be only 8,000 by yearend 1978. Wenela (the official recruiting organization of South Africa) was expected to continue recruitment at a rate of about 10,000 workers per year for the next 5 years. At present levels of pay, workers were sending back to their homes in Rhodesia about $580,000 per month.[3]

PRODUCTION AND TRADE

After independence was achieved formally on April 18, 1980, the new Zimbabwe Government published the first official production figures to be made available to the public since UDI.[4] Based on this report, the production figures were revised on table 1 of this report for the following commodities: asbestos, gold, chromite, coal, copper (mine production), nickel (mine production), iron ore, silver, cobalt, and smelter tin. Because of late receipt of the data, however, the new figures could not be used in the 1978-1979 commodity reports appearing in Volume I of the U.S. Bureau of Mines Minerals Yearbook, with exception of the chapters on silver and chromite.

Mineral production was valued at $363.2 million in 1978 and about $432 million in 1979, compared with $341.9 million in 1977. Higher metal prices, particularly gold, helped in maintaining the record income for both 1978 and 1979. Prices for commodities such as nickel, copper, chromite, and steel remained low in 1978 (causing cuts in production and stockpiling), but generally enhanced prices for gold, silver, tin, tantalite, tungsten, lithium, coal, and emeralds accounted for the increased market realization. Most of the latter-named minerals were produced for the export market. The surge in nickel prices during 1979 gave new life to Rhodesia's ailing nickel mines, adding foreign exchange earnings of about $70 million. Cobalt production increased markedly in 1979 and exports were expected to be in the region of 50 tons per year of contained metal.[5] The security situation prevented production at some smaller mines in outlying areas.

Nonmetallic mineral products, which consisted mainly of cement and other building materials, suffered the worst downturn of all mineral products during what has been a 4-year recession for the construction industry. For 10 years, up to the end of 1974, production of this sector had been increasing at about 12% per year. Until 1979, however, there had been a steady downward trend. Seasonally adjusted figures show that output for the construction industry for the first 8 months of 1978 was 32.3% below the volume produced in the same period of 1977.[6] Construction, mining, manufacturing, and banking sections all improved in the first few months of 1979, compared with those of 1978, and statistics were indicating a dramatic upturn in the economy by yearend.

Detailed import and export information has not been available since 1965 for security reasons. In 1978, exports increased by 13% in value while imports were curtailed. In the first half of 1978, Rhodesian businessmen were being asked to make across-the-board cutbacks in import allocations by as much as 20% in many instances.[7] The cutbacks reflected difficulties in exports that were mainly attributable to international economic demands in general, rather than to sanctions alone. Continuing sanctions, however, were aggravating the situation. The Swiss Government tightened sanctions against Rhodesia at yearend 1977. In December 1978, Dutch officials seized Rhodesian chrome worth $23.4 million en route to an Austrian ferroalloys smelter.[8] It was also established that U.S.S.R. had been buying chrome from Rhodesia in contravention of United Nations sanctions. Reportedly purchased at $32 per ton, it was resold in the United States at $58 per ton.[9]

In 1979, total exports were estimated at $1,000 million and imports at $893 million. With an end to sanctions, exports were expected to increase by about 30%, but a trade deficit was also expected. Dividends and earnings of foreign-owned businesses were to remain frozen until further notice despite the end of sanctions.[10]

The railway route from Zambia and Rhodesia was re-opened by the Zambian Government in October 1978 after a 5-year closure. It was a move forced by the inability of northern and Tanzanian railways to handle vital copper exports and fertilizer and corn imports. Rhodesia refused to reopen the Kazungula ferry route, which it had destroyed in eary 1978. By June 1979, at least 600,000 tons of corn, fertilizer, and other products were being stockpiled in South African ports waiting shipment to Zambia. A series of clandestine meetings were being held between Rhodesia and Zambia in the hope of reopening road traffic.

Table 1.—Southern Rhodesia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]		1976	1977	1978[p]	1979[e]
METALS					
Aluminum: Bauxite, gross weight		2,000	2,000	--	--
Antimony, mine output metal content[e]		300	300	250	250
Beryllium: Beryl concentrate, gross weight[e]		60	60	45	45
Chromium: Chromite, gross weight	thousand tons	864	677	478	[3]542
Cobalt:					
Mine output, metal content, recoverable[e]		NA	NA	NA	210
Metal, including content of refinery sludges		--	--	17	[3]204
Columbium-tantalum minerals: Tantalite, gross weight[e]		40	40	40	45
Copper:					
Mine output, metal content		[r]41,300	34,800	33,800	[3]29,600
Metal, primary:[e]					
Smelter		[r]23,500	28,000	26,240	28,000
Refined		23,500	28,200	26,200	27,500
Gold, mine output, metal content	thousand troy ounces	387	402	399	[3]386
Iron and steel:					
Iron ore, gross weight	thousand tons	1,353	1,176	1,123	[3]1,201
Ferroalloys:					
Ferromanganese		NA	NA	NA	[3]2,400
Ferrosilicon		NA	NA	NA	[3]36,000
Ferrochromium[e]		185,000	200,000	200,000	200,000
Total		NA	NA	NA	238,400
Crude steel[e]	thousand tons	[r]1,000	[r]900	900	900
Nickel:					
Mine output, metal content		14,604	[r]16,671	15,701	[3]14,591
Metal, smelter[e] [4]		10,000	13,000	13,000	13,200
Silver, mine output, metal content	thousand troy ounces	200	207	1,109	977
Tin:[e]					
Mine output, metal content		[r]920	[r]920	950	950
Metal, smelter		915	920	945	[3]947
Tungsten, mine output, metal content		[r]60	[r]60	60	60
NONMETALS					
Asbestos	thousand tons	281	273	249	[3]260
Cement, hydraulic	do	540	492	408	[3]396
Corundum, natural		4,000	4,000	4,000	4,000
Fluorspar[e]		200	200	200	200
Lithium minerals, gross weight[e] [5]		[r]9,000	9,000	8,000	8,000
Magnesite[e]		20,000	20,000	42,000	42,000
Nitrogen, N content of ammonia	thousand tons	70	70	60	60
Phosphate rock, marketable concentrate[e]	do	130	140	140	140
Pyrite, gross weight[e]	do	75	75	75	75
Sulfur:[e]					
S content of pyrite	do	[r]40	[r]40	40	40
Byproduct of coal and metallurgy	do	[r]5	[r]5	5	5
Total	do	[r]45	[r]45	45	45
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous	do	[r]3,593	3,029	3,065	[3]3,188
Coke, metallurgical[6]	do	227	194	179	[3]262

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] For the first time in 16 years, official figures were published on output of a number of mineral commodities produced in Southern Rhodesia in the May 1980 issue of the Zimbabwe Monthly Digest of Statistics. These data covered production of chromite, cobalt metal, mine copper, mine gold, iron ore, mine nickel, mine silver, tin metal, asbestos, and coal; the availability of these data made revisions necessary in estimates for output of pig iron, crude steel, and mine tin. In addition, some company data became available on production of coke and ferroalloys for 1979 and were incorporated in this table.

[2] In addition to the commodities listed, modest quantities of unspecified types of crude construction materials (including clays, stone, and sand and gravel) were produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels. Also, graphite and mica have been produced in the past and output presumably has continued, but no basis for estimates of output levels is available.

[3] Reported figure.

[4] Includes Ni content of nickel oxide and nickel fonte.

[5] Data represent only an approximate order of magnitude.

[6] Data represent sales for years ending Aug. 31 of that stated by Wankie Colliery only; additional coke is produced at the Redcliff steel plant of Rhodesian Iron and Steel Company (RISCO), but data on production there are not available.

COMMODITY REVIEW

METALS

Chromite.—A standard friability test for chromium ores was devised and reported on by Rhodesia's Institute of Mining Research (IMR).[11] The friability of chromium ore largely determined its sales potential, thus the importance of the friability factor to both miners and ferroalloy producers. The unique test devised by the IMR was a simple and economical one which expressed in percentages the commonly used terms "hard lumpy," "lumpy," "friable," "semi-friable," and "friable lumpy," and which thus more clearly indicated the potential suitability of the ores for smelting. For instance, ores with friability of less than 15% fell within the category of "hard lumpy" and were well-suited to the production of high-carbon ferrochromium. "Lumpy" ores had a friability range of 15% to 25%. From 25% to 60% friability, however, the ores fell into less definitive categories. The test was expected to have wide application in Rhodesia. Union Carbide of the United States estimated their Rhodesian chromite mine assets at $25.8 million. With removal of sanctions on December 16, 1979, the U.S. companies were expected to renew importing Rhodesian chrome and ferrochrome.

Copper.—M.T.D. Mangula announced a 60% fall in taxed profits for the 6-month period ending in April 1978. Even so, the company was expanding capacity, with the extensions at the Norah mine being completed in 1977 and at Mangula in April of 1978. For the year ending September 30, 1979, the combined production for both mines was 16,440 tons of copper, compared with 17,369 tons of copper for the same 1978 period. Ore reserves had been maintained at 17.5 million tons, but the grade had risen from 1.25% to 1.30% copper as a result of the exclusion of lowergrade areas from mining at Mangula. By yearend 1978, it was evident that a strong rise in copper prices would continue, and the country's main copper producers were reexamining the feasibility of either reopening closed mines and section of mines, or cautiously expanding production levels previously scaled down because of low prices. In November 1979, M.T.D.'s Lomagundi Smelting and Mining (Pvt.) Ltd. began construction of an electrolytic copper refinery adjacent to the Alaska copper smelter, which in 1978 had produced 26,240 tons of blister copper. The cost to build the 20,000-ton-per-year refinery was estimated at $7.6 million and was to be financed through local loans. In addition to some local fire-refining, copper refining had been carried out in South Africa. Early in 1978, Lonrho announced plans to purchase the 50% interest in the Nyaschere copper company that it did not already own. This was considered the most satisfactory solution to financial problems that had arisen. Corsyn Consolidated Mines produced copper from the Inyati and Muriel properties. For financial year ending September 30, 1978, a total of 3,553 tons of copper was produced from 256,000 tons of ore milled from both mines.

Gold.—As the price of gold moved from $160 at the end of 1977 to $185 per troy ounce at the middle of 1978 and $700 per ounce by 1979, the Rhodesian Ministry of Mines and the Chamber of Mines were actively reassessing the country's gold potential. So far some 1,300 gold mines had been cataloged. Apart from the suspected presence of many new deposits, many of the old mines appeared to offer considerable scope for redevelopment. The Ministry of Mines issued a list of all known dormant gold mines in late September 1979 as an aid to prospective small workers. A new shaft was sunk at Falcon Mines Ltd's Dalny gold mine to allow more extensive work to be carried out at deeper levels. The 2-year project was finished at yearend 1979. The Dalny also crushed and milled all the ore from neighboring mines, including the Venice. About 5,000 tons of ore from the Venice mine was processed per month at the Dalny facilities. In the financial year ending September 30, 1979, the Dalny mine produced 52,896 troy ounces of gold compared with 55,849 troy ounces for the same 1978 period. Coronation Syndicate produced about 2.2 tons of gold from its Arcturus, Mazoe, Muriel, and Maskona Kop operations and as a by product from the Inyati copper mine. Blanket Mines Pvt produced about 0.5 ton of gold from the Blanket mine. Rio Tinto announced plans to expand the Renco gold mine and indicated their Zinca platinum prospect may be developed.

Iron Ore.—The IMR was carrying out a general review of iron formations and their associated iron ore deposits throughout Rhodesia. Detailed mapping was being done in the Buchwa, Manisi, and Redcliff areas. The project also included geochemical studies of samples from the West deposit at Buchwa, the Ripple Creek and South Hill ore bodies at Redcliff, and the Rho-Iron claims at Manisi. Geophysical investigations were also done. Preliminary results of these studies were given in a recent report.[12]

Iron and Steel.—The Government was providing further subsidies to the Rhodesian Iron and Steel Company (RISCO), as well as increasing its equity stake in the group to 49.7%. Government support for RISCO over the last 3 years totaled over $130 million. The company officially changed its name to RISCO Limited, effective August 28, 1979. No. 3 furnace, closed down since February 1977, was brought back into full production in November 1978. The No. 4 furnace was shut down in April 1979 for a short period for relining and overhauling. Several modifications, including a better water cooling system and improvements to hot air and gas pipes were being made. Meanwhile, much of the additional steel produced by the two furnaces was stockpiled to cushion the effect of the closure.[13] Output from the No. 4 furnace alone in 1977 was 654,000 tons of pig iron.[14]

Nickel.—The Shangani Mining Corporation Ltd. (49% Johannesburg Consolidated Investment Co. Ltd. (JCI)) operated a nickel mine situated northeast of Bulawayo. Concentrates produced by the mine were processed by Bindura Smelting and Refining Company at its plant, located 100 kilometers northeast of Salisbury. Trial milling commenced in October 1975, and the mine began production from the open pit on March 1, 1976. The underground mine was expected to start production in early 1980. Burdened with a massive $40 million debt loan and struggling against depressed nickel prices on world markets, Shangani had experienced a loss since the mine began. In 1978, the net loss for the financial year was $3.1 million; this, brought forward, gave an accumulated loss of $8.5 million.[15] By yearend 1978, it was announced that production of ore from Shangani would be discontinued for about 6 months in 1979, but revenues would continue to be earned from stockpiled ore. By yearend 1979, financial results had been better than anticipated. Nickel prices had improved measurably and the company expected to be able to cover interest payments on loans. Production of ore from the East pit had been stepped up from 50,000 tons per month to 75,000 tons per month earlier in 1978 because pit walls were deteriorating. This action followed a production cut in November 1977 by half in an effort to cut expenses and more closely match production with sales. Operations in the East pit continued on a reduced scale until reserves were finished in April 1979.

Anglo American Corporation (AAC) was appointed secretary, technical advisor, and buyer for the Shangani Mining Corporation effective April 1, 1978. AAC provided similar services through its Salisbury office to the Rhodesian Nickel Corporation (RHONICK), which has joint smelting and refining facilities with Shangani. JCI considered a Salisbury management base would allow a more rational use of resources. JCI expected to continue its investment and representation on the Shangani Mining Corporation's board and executive committees. Rhonick assumed the name of Bindura Nickel Corporation in 1979. The company had a $29 million tax loss for the year ending April 1979.

Although lower in grade, the tonnage of ore milled at RHONICK's Trojan mine was higher for the fiscal year ending June 30, 1978, than for the comparable 1977 period, and the production of nickel in the concentrate was highest ever achieved by the mine. Underground mining capacity had been extended at RHONICK's Epoch mine so that the average production rate during the year was 35,000 tons per month. Minor plant modifications, careful operational control, and improvements in metallurgical recovery, coupled with a marginal improvement in mill head grade resulted in the recovered nickel in concentrates being 40% higher than in fiscal year 1977. At Madziwa mine, various methods to refine mining were being pursued in order to exclude as much waste as possible and increase the nickel grade above the historical 0.60%. The Madziwa ore bodies were extremely erratic and complex. Dilution of ore by waste rock resulted from the contorted ore body outlines and random distribution of ore with barren inclusions. Security commitments were also placing a very heavy load on staff at Madziwa where mine personnel were on regular standby.

Part of the brickwork of the electric smelting furnace at Bindura Smelting and Refining collapsed on Dec. 17, 1978, as a result of recent operating difficulties.

The furnace was out of commission for 8 weeks.[16]

Because of higher nickel and gold prices Rio Tinto Rhodesia showed a profit after tax of nearly $3.7 million for the 9-month period to September 30, 1979, compared with $2.2 million for the same 1978 period. Profit for the last quarter was helped by the high gold price, but the Empress nickel mine earned lower profits. Empress nickel profits dropped because of a drop in production resulting from ore processing difficulties. The Empress was a low-cost producer, but the profit margin at current prices was small. The planned major exploration program for additional nickel ore was also severely hampered by military commitments and the deteriorating security situation. The mine had proven ore reserves of 10.5 million tons with a nickel and copper content of 1.27%, giving a minimum life of 10 years.[17] A breakthrough in a metallurgical method enabling the extraction of gold, platinum, and palladium from the nickel ore was announced by the company in 1979. Rio Tinto had been working on a modified Finnish process which appeared successful. Although some initial problems were encountered, production from the new precious metals plant was expected in early 1980.

An investigation was undertaken to determine whether a ferrochromium nickel alloy, similar to austenite stainless steel, could be produced directly by smelting a composite charge of nickel silicate and chromium ores derived from the Great Dyke. The nickel silicate thus obtained and used in the initial smelting tests had a low 1.2% nickel content and was predominantly composed of silica and magnesia with some iron oxide and residual chromium. The smelting tests established the practical feasibility of the process, and it was recommended that an extensive survey be carried out to determine the nickel-bearing weathered serpentinite reserves on the Great Dyke and elsewhere. Surveys into the marketability of the alloys and the economic aspects of large-scale production were also necessary. By increasing the proportion of nickel silicate to chromium ore in the charge, it was determined that a range of alloys would be produced with increasing nickel and decreasing chromium contents.[18]

Tungsten.—Scheelite accounted for 65% of the total tungsten mineral production, but this portion was expected to diminish relative to wolframite production in the future. Although over 400 mines contributed to the national production, about 75% of the production was derived from about 5% of the mines. The R.H.A. mine accounted for most of the wolframite production from the deposits of the Wankie area. The P&O mine, in which scheelite was dominant, was a large producer in the Sabi River area near the Mozambique border. The Hippo mine was dormant but had been the largest wolframite producer in the Sabi area. The Mapani mine, adjacent to the P & O mine, produced more wolframite than scheelite and was the largest current producer of the Sabi area. At the Mapani, the ore occurred with copper, gold, and silver minerals in quartz and calcite-filled fault breccia. Scheelite often had a similar distribution to gold and was a byproduct of many gold mines; it also commonly occurred with iron, copper, and lead sulfides in low-temperature quartz veins. The Scheelite King mine, one of the largest producers, was sited in a skarn zone adjacent to the Jumbo granite, north of Salisbury. The Beardmore mine, situated near Bikita, produced about 100 tons of contained tungsten oxide in concentrates per year and was also associated with coarse aggregates of epidote, garnet, and vesuvianite in greenstone near a granite contact. The R.A.N. and Golden Valley mines, located near Bindura, were examples of gold mines rich in scheelite.[19]

NONMETALS

Asbestos.—The King mine produced chrysotile asbestos of high quality from ore bodies which were developed in serpentinized host rocks of the Fort Victoria Schist Belt of Archean age. The mine was situated 7.5 kilometers southeast of Mashaba and 40 kilometers west of Fort Victoria. Silky chrysotile fiber seams form a stockwork in three ore bodies named the Main, Western, and Central. The complex geological and structural environments in which the Gath, King, and Shabanie mines were developed have posed difficulties in the design and implementation of underground mining methods. As a result, the block cave technique was continually revised, and a code for design of block caving stopes was formulated.[20]

Bauxite.—Deposits of bauxite have been known and mined for many years in the Eastern Highlands and adjoining areas of Mozambique. Despite the small production from the Alumen Claims, Penhalonga, little exploratory work was carried out to prove the extent of reserves. The ore was being used entirely for the production of aluminum sulfate.[21]

Cement.—Sales of cement by the Salisbury Portland Cement Company, located in Salisbury, dropped 12% from 186,000 tons to 163,000 tons in the year ended November 30, 1978. The drop in cement sales was caused by a continued decline in the construction industry. Limestone for use in cement was produced by the Abadan Slate (Pvt.) Ltd. of Bulawayo, the Dodge Mineral Production Co. (Pvt.) Ltd. of Salisbury, and by the Early Worm Mining Co. (Pvt.) Ltd. in Concession.[22]

Clays.—In Rhodesia, refractory and semirefractory clays occur in the Karoo System associated with the coal measures. The main deposits of flint clays investigated are those of the Lower Sabi coalfield near Chiredzi and Chivumburu Hill. Based on available information, the minimum tonnages shown on table 2 were indicated:[23]

Table 2.—Deposits of flint clays

Area	Million tons
Dambalangwe	2.5
Sangabwe	6.0
Chipolo	1.0
Nyawagi	3.8
Gozonya	4.0
East of the Chiredzi River	16.0

An unknown quantity of flint clay also occurs between Sangabwe and Gozonya and east of Gozonya. Problems of selective mining, necessitated by the variable thickness of associated ferruginous layers, have to be overcome for economical exploitation. There is only one known kaolin deposit, the Alumens Claims, located north of Umtali. The kaolin formed as a weathering product of anorthosite.

The Rhodesian-based company G & W Industrial Mineral (Pvt.) Ltd. was mining bentonite for domestic consumption. The company was an associate of Zimro (Pty.) Ltd. of South Africa and also mined iron oxide pigments in the Gwelo District.

Diamond.—Kimberlitic Searches Ltd. continued to prospect for diamonds and met with some success in the discovery of a diamondiferous kimberlite intrusive into rocks of the Limpopo Mobile Belt near Beitbridge. The deposit was still under investigation.[24] Kimberlites were known to occur in Rhodesia at 21 localities; ten were found on the craton, two in the Limpopo Mobile Belt, and nine in Karoo rocks. These intrusions were not always diamondiferous, and had thus far been uneconomic where stones had been found. A recent Rhodesia Geological Survey article described the kimberlites of Rhodesia.[25]

Euclase.—The occurrence of euclase, a member of the datolite group of minerals, was described in a recent article by the Rhodesia Geological Survey.[26] The hydrated beryllium-aluminum silicate occurred as a low-temperature replacement of beryl in the Miami pegmatite field, located north of Karoi. Economic minerals found in the younger pegmatites of this area include beryl, mica, tantalite, and cassiterite; the quartz veins contain wolframite. Some spectacular aggregates of euclase were produced from the Last Hope, Last Hope 3, Mishek, Falls and Trim, and the Rattis mines. Most of the mineral was being stockpiled while a lucrative market was being sought. Some of the dark blue, paling to light blue crystals were transparent and of gem quality.

Magnesite.—Work was nearly complete on the $520,000 expansion project at Gatooma Magnesite, a medium-grade magnesite mine in the Midlands on the Barton Farm, which was jointly owned by the South Africa companies Vereeniging Refractories (Verref) and Cullinan Refractories. A new shaft began in December 1978, and the target date for completion of the project was October 1980. The Gatooma Magnesite mine started in 1939 as a quarrying operation, and underground work started in 1964 when Verref took over. The mine has a currently assessed life of about 12 years.[27]

Slate.—Premier Slates, a company mining slate from a quarry near Feathersone, declared the mine's product to have tremendous export potential. The market for billiard table tops alone was considered a potentially large one. Premier Slates had received an inquiry for supplying 40,000 table tops.[28]

Sulfur.—It was estimated that Anglo American Corp. Rhodesia Ltd. (Amrho) had a production capacity of 45,000 tons per year of recovered combined sulfur,[29] as a byproduct of metal and coal mining and the Iron Duke pyrite mine.

MINERAL FUELS

Coal.—Wankie Colliery (Anglo American Corp.) reported lower profits and 3,065,000 tons mined in 1978. Coal production improved in 1979 when 3,188,000 tons was produced, but demand and profits were still low. The Government agreed to allow a 10% price increase effective the first of August, 1979. Closed since October 1, 1977, it appeared that the number 4 underground colliery would remain closed for longer than anticipated, but plant and equipment were to be maintained. A lack of adequate railroad transportation had been a major constraint in coal sales. A new 1,300-megawatt power station was to be built at the Wankie mine site and would necessitate an expansion in production of coal. The coke ovens were operated at a minimum during 1978, and it was possible to reduce Wankie's large coke stockpile. Coke sales for fiscal year 1979 ending August 31, 1979, were 261,471 compared with 178,971 tons for the same 1978 period. Coke exports had proved important, since the domestic demand had slackened.[30]

Petroleum.—Sabotage, destroying 22 of 28 petroleum storage tanks in late 1978, was considered to be one of the biggest economic setbacks since the internal strife began. Located near Salisbury, the tanks were owned by Shell, British Petroleum, Total (France), Caltex, and Mobil Oil Co. Rhodesian-based oil companies distributed strictly rationed fuel that had been imported through South Africa, mainly from Iran. An estimated 17 million gallons of diesel, aviation fuel, and gasoline were destroyed in the attack.[31] The domestic price of premium gasoline increased by almost 80% during 1979 and the impact of buying oil in spot markets had affected all markets; a unit (5 liters) of premium gasoline cost $3.60 in July 1979. Rhodesia was expecting to produce enough ethanol by 1980 to provide 15% of Rhodesia's gasoline supplies. Ethanol would eventually form 15% of diesel supplies and 20% of gasoline.

Before independence, Rhodesia got most of its crude oil by pipeline from Beira, Mozambique. The oil companies shut the pipeline in December 1965 in response to sanctions law. Oil began to be delivered first by truck from South Africa and then by rail through Mozambique and more recently through South Africa. The five oil companies apparently dropped all competition and allowed the Rhodesian Government company, GENTA, to allocate business to insure that each company maintained its market share.

A new $1 million oil re-refining plant was completed by Shell and British Petroleum. Only about 16% of the oil used in the country was currently being re-refined, but it was hoped to raise this to 30%.

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The Mineral Industry of Romania

By George Rabchevsky[1]

Romania in 1978-79 did not meet its production targets in national income, industrial production, agriculture, and foreign trade. The 1979 investment target was not realized, even though it was at lei 206.2 billion[2] or 5.1% over that of 1978. The industrial sector received almost half of the investments in 1978, and almost 60% in 1979. Industry continued to be a priority for development in Romania's overall planning. In 1978 and 1979 the industrial production posted a 9% and 9.1% increase, respectively, which is below the planned targets of 10.6% and 11.3%. The output was particularly below planned levels for the petrochemical industry, which was restrained by the imposed energy conservation measures, import prices, and the major accident at the Pitesti refinery. Other industrial sectors where targets were not reached included coal, steel, crude oil, and electric energy.

Wages are to be increased by 13.6% in 1978, affecting mining, oil, gas, and coke industries, as well as engineering and geological research. According to Vasile Patilinet, Minister of Mines, Oil and Geology, during the current 5-year plan the salaries of miners were increased by 38.2% and those of geology and drilling personnel by 35.9%.

Romania in 1978 incurred a sizable foreign trade deficit, primarily due to its import increases in energy and raw material needs and escalating prices. Imports grew significantly faster than exports, with petroleum accounting for a sizable part of Romania's hard currency expenditures.[3]

Despite the problems in productivity, resources availability, and energy, the 1980 Romanian plan calls for a continued rapid development of the economy, already COMECON's[4] fastest growing. Energy self-sufficiency is in the forefront of the Romanian 1980 policy. The extraction of domestic crude oil and the consumption of hydrocarbons will be frozen at present levels, while mining of coal and utilization of hydropower will be substantially increased. What crude Romania plans to import, will be refined domestically and eventually reexported to boost its hard currency needs.

In accordance with the policy of continued development of its indigenous raw materials base, the 1980 plan again envisages intensified geological research and exploration programs, maximum utilization of all domestic resources, recovery of secondary products and waste, reduced oil consumption, and more efficient utilization of metals. Coal and nuclear power are to be developed rapidly under the plan. New coal mines are to be opened, substantially boosting production over 1979. Improved secondary recovery techniques will be employed for a more efficient exploitation of the less productive oil reservoirs. The production of crude oil and natural gas will remain at approximately the 1979 level. The 1980 goals of the domestic economy as a whole are modest and more realistic than the previous aspirations. National income is planned to advance 8.8%, industrial production 11.5%, total investments 4.9% (at lei 245 billion), and foreign trade turnover 14.8% (at a new high of lei 130.9 billion). Foreign trade will continue to be promoted with all countries in all categories, emphasis put on exports of Romanian-built equipment and machinery, technical services, and refined petroleum products.

PRODUCTION

Romanian reserves of raw materials are at the point of depletion and to sustain its existing processing facilities and output, Romania continues to rely increasingly on imports of ores and mineral fuels. This pertains especially to the bauxite, iron, lead and zinc ores, and metallurgical coke. Lignite is the only mineral fuel in abundance, which is being relied on more intensly as a substitute for the generation of power, eventually replacing hydrocarbons. Cement is the only other commerical mineral with a steadily increasing production, with plentiful reserves skirting the Carpathian Chain. Reportedly, oil was discovered offshore in the Black Sea in 1979, the reserves and production, however, are as yet uncertain and have not been reported officially. Production from the Ploesti Fields can now be sustained only by secondary recovery. Thus, even though, Romania is attempting to reach self-sufficiency in energy and mineral production, no new reserves were discovered or new mines were opened in 1978-79, except coal. Conservation of resources, lowered consumption, and emphasis on mineral processing and metallurgy industries remained a national priority during the current 5-year plan.

The gross value output of ferrous and nonferrous metallurgy increased 8.7% and 5.7%, respectively, in 1978, with some plants, such as the Slatina aluminum reduction plant being expanded, even though almost 50% of the bauxite had to be imported from Greece and Yugoslavia. To streamline quality and productivity, automation is being introduced wherever possible. In 1978-79, the machine building industry grew by more than 13%. Nevertheless, a number of equipment manufacturing plants and metallurgical complexes did not fulfill the prescribed quotas or meet the expected production plans. Significant construction delays were reported by fertilizer, petrochemical, and metallurgical industries. For example, material shortages and production delays occurred at the Galati Tirgobiste and Resita Ferrous Metals Combines, the "1 May" petroleum equipment plant at Ploiesti, the Medgidia II Cement and Lime plants, and others. The delays caused shortfalls in steel and rolled products output[6].

In 1979, President Nicolae Ceausescu visited a number of mining areas, and later criticized the miners and officials for inefficiency and poor performance. As a result of that visit, Vasile Patilinet, Minister of Mines, Oil and Geology, was fired and replaced by Virgil Trofin.

Table 1.—Romania: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978^{p}	1979^{e}
METALS				
Aluminum:				
Bauxite, gross weight	^{r}680,000	702,000	707,767	708,000
Alumina, calcined, gross weight	^{r}425,000	^{r}442,000	449,000	500,000
Ingot including alloys:				
Primary	207,000	209,000	213,000	215,000
Secondary	18,000	17,000	18,000	18,000
Total	225,000	226,000	231,000	233,000
Bismuth, mine output, metal content^{e}	80	80	80	[illegible]
Cadmium metal, smelter^{e}	100	90	90	[illegible]
Copper:				
Mine output, metal content^{e}	23,000	27,000	27,000	27,000
Metal:				
Smelter:				
Primary	^{r}40,491	41,429	38,880	39,000
Secondary	5,000	4,000	4,000	4,000
Total	^{r}45,491	45,429	42,880	43,000
Refined, primary and secondary	38,000	40,000	40,488	40,500
Gold, mine output, metal content^{e} troy ounces	60,000	65,000	65,000	65,000

See footnotes at end of table.

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Table 1.—Romania: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS —Continued				
Iron and steel:				
Iron ore thousand tons	[r]2,835	2,467	2,511	2,600
Metal:				
Pig iron do.	7,415	7,784	8,155	8,300
Crude steel do.	10,733	11,457	11,779	12,500
Semimanufactures:				
Castings and forgings, finished do.	[e]950	[e]1,000	1,097	1,100
Pipes and tubes do.	1,216	1,320	1,419	1,500
Rolled products do.	7,305	8,392	8,958	9,500
Lead:				
Mine output, metal content	35,000	35,000	33,300	33,300
Metal, smelter, primary and secondary	[r]42,465	41,702	42,815	43,000
Manganese:[e]				
Ore:				
Gross weight	80,000	80,000	80,000	80,000
Metal content	17,000	17,000	17,000	17,000
Concentrate, gross weight	28,000	28,000	28,000	28,000
Silver, mine output, metal content thousand troy ounces	1,220	1,125	1,030	1,030
Zinc:				
Mine output, metal content	67,000	62,000	60,000	60,000
Metal, smelter, primary and secondary	[r]53,373	51,860	49,790	48,500
NONMETALS				
Barite	[e]85,000	[e]85,000	87,300	88,000
Cement, hydraulic thousand tons	13,088	13,875	14,688	[2]15,600
Clays:				
Bentonite	63,000	63,000	65,000	65,000
Kaolin	90,000	90,000	90,000	90,000
Diatomite[e]	40,000	40,000	40,000	40,000
Feldspar[e]	58,000	60,000	60,000	60,000
Fluorspar[e]	15,000	20,000	20,000	20,000
Graphite[e]	6,000	6,000	6,000	6,000
Lime thousand tons	3,320	3,446	3,657	3,750
Nitrogen, N content of ammonia do.	[r]1,659	1,792	2,257	2,360
Pyrite, gross weight[e] do.	870	915	920	930
Salt:				
Rock salt do.	NA	NA	1,657	1,700
Other do.	NA	NA	3,082	3,100
Total do.	4,210	4,535	4,739	4,800
Sand do.	NA	NA	[e]1,367	1,400
Sodium compounds:				
Caustic soda do.	673	735	725	730
Sodium carbonate, manufactured, 100% Na_2CO_3 basis do.	814	861	899	925
Sulfur:				
S content of pyrite[e] do.	375	395	400	425
Byproduct, all sources[e] do.	98	110	120	130
Total[e] do.	473	505	520	555
Sulfuric acid do.	1,555	1,523	1,655	1,660
Talc[e]	60,000	60,000	66,000	60,000
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	91,282	100,433	108,964	109,000
Coal:				
Run-of-mine:				
Anthracite and bituminous thousand tons	8,696	8,637	8,794	9,160
Brown do.	600	635	641	668
Lignite do.	18,819	19,872	22,019	22,936
Total do.	28,115	29,144	31,454	[2]32,764
Washed (produced from above):				
Anthracite and bituminous:				
For coke and semicoke production do.	1,924	2,154	2,450	2,600
For other uses do.	5,187	4,993	4,968	5,170
Brown do.	567	603	606	630
Lignite do.	18,164	19,028	21,239	22,100
Total do.	25,842	26,778	29,263	30,500

See footnotes at end of table.

Table 1.—Romania: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coke:				
Metallurgical ____ thousand tons__	2,472	3,148	3,458	3,600
Other ____ do____	357	396	384	290
Total ____ do____	2,829	3,544	3,842	3,890
Fuel briquets (from brown coal) ____ do____	NA	NA	711	720
Gas:				
Manufactured: Coke oven ____ million cubic feet__	[e]37,000	NA	NA	NA
Natural:				
Gross:				
Associated ____ do____	222,940	230,462	232,016	207,300
Nonassociated ____ do____	1,053,573	1,015,468	1,023,167	[2]960,160
Total ____ do____	1,276,513	1,245,930	1,255,183	1,167,460
Marketed ____ do____	1,136,432	[e]1,103,620	[e]1,111,590	1,083,900
Natural gas liquids ____ thousand 42-gallon barrels__	3,190	3,740	NA	NA
Petroleum:				
Crude:				
As reported ____ thousand tons__	14,700	14,650	13,794	[2]12,323
Converted ____ thousand 42-gallon barrels__	109.559	109,186	102,806	91,543
Refinery products:[3]				
Gasoline ____ do____	38,395	37,961	42,440	43,000
Jet fuel and kerosine ____ do____	8,742	8,029	7,789	8,000
Distillate fuel oil ____ do____	46,901	48,356	52,324	[illegible]
Residual fuel oil ____ do____	50,829	50,989	60,912	61,000
Lubricants ____ do____	4,676	4,242	4,669	5,000
Other:				
Liquefied petroleum gas ____ do____	3,097	3,144	2,802	3,000
Asphalt ____ do____	3,951	4,357	4,400	4,500
Total ____ do____	156,591	157,078	175,336	177,000

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, antimony, asbestos, gypsum, and a variety of crude construction materials are produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

[3] Romanian sources do not indicate whether refinery fuel is reported as a part of the listed product yields. Moreover, additional minor products may be produced but are not listed in official sources.

TRADE

Romania is a centrally planned economy country which follows a more independent economic and foreign policy within the COMECON and has attempted to cultivate commercial ties worldwide. Romania is a mineral-poor country, and has to import most of its raw materials, including oil. Iron ore, lead, zinc, and coke are all imported due to the depletion of indigenous deposits, to maintain the manufacturing plants and refineries in operation. About 40% of Romania's imports consist of raw materials and 60% of finished goods and spare parts.

Romania's primary export commodity is petroleum products, mining, and oil drilling equipment. Technical services and even investment credits have also been negotiated, especially with the developing countries. Most of the trade conducted, however, is with the advanced developing countries and those rich in natural resources. A number of joint ventures have been signed, such as the Peruvian-Romanian Anatamina Co. project for the exploration and mining of copper and zinc deposits. Reportedly, Romania and Bangladesh reached an agreement in 1979 on joint ventures in coal mining, the use of gas and petrochemicals, and oil prospecting, as part of the joint commissions for economic and technical cooperation held in Bucharest. A joint exploration program for potash-bearing brines in the Jhelum District of the Punjab Province of India was being established in 1978. Cooperative exploration projects also exist with Guinea for bauxite, and with Burundi for nickel. A joint copper exploration and production company was established in 1979 with Zambia, with a U.S. $50 million credit granted by Romania to Zambia for the purchase of Romanian-made installations and equipment. As in numerous previous agreements, however, it may be postponed or never even implemented. A joint petroleum exploration program was signed with Egypt in 1979. That year, Romania and Greece agreed to increase trade exchanges (which already registered a 64% jump in 1978 over the previous year), and also to continue cooperation in the search for oil. Bauxite has been imported from Greece for a number of years. Oil refineries and mineral processing plants have been built with Romanian assistance in Turkey, Egypt, Syria, India, Pakistan, and Yugoslavia. Romania and Yugoslavia are also involved in a number of other energy-related joint ventures, such as the construction of the Iron Gates I and II hydroelectric plants.

Increased exports have always been the goal and concern of the Romanian foreign trade policy. Trade imbalance, however, continued to persist and in 1978 the deficit amounted to a record high of lei 3.8 billion. Imports climbed 16.5% (15.1% in 1977) and exports were up only 5.5% (14.4% in 1977). The 1979 export target of 16.6% was at 18%, and import was 20% over that of 1978. Foreign trade turnover (exports plus imports) in 1979 was at lei 93.3 billion, 19.1% over that of 1978, and 1.1% over the planned target. To stimulate exports, the Romanian Government was actively seeking trade agreements and attempted to upgrade the quality of its goods and services. The emphasis on better and more sophisticated commodity production was intended to generate higher values for given amounts of materials, fuels, and energy, often accompanied by profit incentives to the plants and its employees.[7]

România continued to trade with the COMECON countries (46.3% of total in 1978) and, in addition to the traditional imports, crude oil may be purchased from the Soviet Union for the first time in 1980. Iron ore and potassic fertilizer were received from the U.S.S.R., coal and sulphur from Poland, and rolled steel from the German Democratic Republic. Nickel concentrate and reportedly chromite were also imported from Cuba. Overall, trade with the U.S.S.R., Cuba, and other COMECON countries decreased, while it went up 40% with China. Romania was actively soliciting trade agreements also with the African developing countries. In spring of 1979, President Nicolae Ceausescu visited many African countries, seeking imports of raw material. To establish and stimulate new sources of supplies, Romania even extended credit to many of those countries. Thus, manganese was being shipped from Gabon, and uranium may be imported from there by 1986. Discussions also centered around oil imports from Angola and Mozambique. The other African countries visited by President Ceausescu included Burundi, Liberia, Zambia, Libya, Sudan, and Egypt, during which treaties of friendship and cooperation were signed.

Most of the Romanian-processed products are bartered or exported for hard currency, which is needed for subsequent foreign purchases. Iron ore and ferroalloys are imported from India, for example, in exchange primarily for Romanian chemical fertilizers and equipment. A 1980 trade protocol was signed with Albania under which Romania will export oil drilling equipment and other machinery in return for Albanian bitumen, sulfur, crude oil, chromium ore, copper and copper products, pyrite concentrate, and consumer goods.[8] A similar goods exchange protocol was also in force in 1979.

In 1978, Romania negotiated an agreement with Canada for delivery on credit of four nuclear reactors. The agreement is of significance, since this was the first sale of a Canadian nuclear reactor to a centrally planned economy country. U.S. mineral exports to Romania in 1979 included bituminous coal and phosphates, while United States imported petroleum products such as naphthas and fuel oil from Romania. The U.S.-Romanian trade reached approximately U.S. $800 million in 1979, of which U.S. exports totaled about U.S. $445 million. Trade with the United States registered the highest increase (40% in 1978) of all market economy countries.

Table 2.—Romania: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum metal including alloys:			
Scrap	4,903	7,160	Italy 3,177; West Germany 2,334.
Unwrought	[3]60,200	[3]70,300	Japan 19,237; Italy 9,527; France 9,022.
Semimanufactures	16,152	27,562	Japan 8,442; United States 5,938; Hungary 2,676.

See footnotes at end of table.

Table 2.—Romania: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Arsenic trioxide	NA	80	All to Singapore.
Chromium:			
Chromite	--	10	All to West Germany.
Oxides and hydroxides	77	47	Japan 34.
Copper metal including alloys:			
Scrap	--	3,561	All to West Germany.
Unwrought	2,058	5,423	Do.
Semimanufactures	NA	260	United States 253.
Iron and steel:			
Roasted pyrite	157,961	146,941	All to Hungary.
Metal:			
Scrap	2,234	3,412	Yugoslavia 2,245; Japan 853.
Pig iron thousand tons	61	114	Japan 78; Austria 33.
Ferroalloys	--	3,621	West Germany 2,888.
Steel, primary forms thousand tons	545	[2]641	Yugoslavia 211; West Germany 10; Austria 82; Italy 64.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	121	[2]324	West Germany 54; Yugoslavia 3; Poland 29.
Plates and sheets do	226	[2]757	West Germany 63; Poland 31; Israel 26.
Hoop and strip	--	231	Yugoslavia 229.
Wire thousand tons	21	[2]117	West Germany 17; Hungary 7; Kenya 6.
Tubes, pipes, fittings do	[2]348	[2]420	West Germany 26; Poland 23.
Castings and forgings do	14	4	West Germany 3; Switzerland 1.
Unspecified do	426	--	
Lead:			
Oxide	NA	5	Yugoslavia 3; Morocco 2.
Metal including alloys, scrap	--	58	All to Italy.
Molybdenum metal including alloys, all forms	--	3	All to West Germany.
Platinum-group metals and silver:			
Waste and sweepings value, thousands	--	$10,000	Do.
Metals, unworked or partly worked:			
Platinum-group do	$429	$12	All to Italy.
Silver do	--	$1,037	All to United Kingdom.
Tungsten metal including alloys, all forms	--	11	All to France.
Other:			
Ash and residue containing nonferrous metals	1,437	603	West Germany 546.
Metalloids	--	199	All to Spain.
Base metals including alloys, all forms	17	14	Italy 10.
Nonferrous metals including alloys, n.e.s.:[3]			
Unwrought	1,342	563	NA.
Semimanufactures	33,048	13,478	NA.
NONMETALS			
Abrasives: Grinding and polishing wheels and stones	266	1	All to Italy.
Asbestos	NA	100	All to Turkey.
Barite and witherite	497	596	All to France.
Boron oxide and acid	100	529	United States 379.
Cement thousand tons	[2]3,098	[2]2,934	Egypt 566; Czechoslovakia 125.
Clays and clay products:			
Crude	NA	650	Egypt 600.
Products:			
Refractory	NA	133	Sudan 111.
Nonrefractory	3,711	5,218	Yugoslavia 4,354; Kenya 747.
Diamond:			
Gem, not set or strung value, thousands	$395	$106	All to Yugoslavia.
Industrial do	$880	$39	All to Belgium-Luxembourg.
Feldspar and fluorspar	140	--	
Fertilizer:			
Crude, nitrogenous	NA	1,600	All to Turkey.
Manufactured:			
Nitrogenous: Urea thousand tons	[2]920	[2]1,043	Turkey 265; Egypt 148.
Phosphatic do	1	18	All to Turkey.
Other, including mixed do	[2]1,304	[2]1,205	Turkey 55; Yugoslavia 55.
Ammonia	153	5,247	All to Yugoslavia.
Gypsum and plasters	21,515	28,203	Hungary 28,134.
Lime	10,454	7,633	All to Hungary.
Pigments, mineral: Iron oxides, processed	NA	139	Thailand 99.
Precious and semiprecious stones value, thousands	--	$1	All to West Germany.
Salt	[2]714,600	[2]780,600	Hungary 389,754; Yugoslavia 103,9
Sodium and potassium compounds, n.e.s.:			
Caustic soda	[2]311,400	[2]303,500	Hungary 44,393; Yugoslavia 25,3
Caustic potash	NA	317	Thailand 100; Italy 98; Yugoslavia
Soda ash	[2]488,900	[2]518,300	Czechoslovakia 47,000; Hungary 21,928.

See footnotes at end of table.

Table 2.—Romania: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Stone, sand and gravel:			
Dimension stone	13,798	16,092	West Germany 12,945; Austria 2,978.
Gravel and crushed rock	132,967	120,946	All to Hungary.
Limestone	--	687	All to West Germany.
Sand	934	1,081	All to Hungary.
Sulfur, elemental	--	1	All to United Kingdom.
Talc	--	22	All to West Germany.
Other:			
Crude	1,563	1,677	Hungary 1,570.
Oxides and hydroxides of magnesium, strontium, barium	NA	25	All to Yugoslavia.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	7,182	5,906	Do.
Carbon black	[2]46,400	[2]45,400	Czechoslovakia 14,443; Thailand 389.
Coal and briquets:			
Anthracite and bituminous coal	12,200	300	All to West Germany.
Lignite and lignite briquets	--	11	Do.
Gas, natural million cubic feet	[2]7,162	[2]7,063	All to Hungary.
Peat and peat briquets	2,665	2,501	Austria 2,210.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	[2]15,184	[2]20,502	West Germany 6,074; Netherlands 5,073.
Kerosine do	18	2,906	United States 2,263; Spain 620.
Distillate fuel oil do	[2]15,108	[2]18,016	Turkey 4,914; France 1,436; Greece 1,324.
Residual fuel oil do	[2]16,662	[2]15,218	Italy 3,050; Sweden 1,665; Yugoslavia 1,565.
Lubricants do	[2]200	[2]2,289	Yugoslavia 217; Spain 88; Hungary 85.
Other:			
Liquefied petroleum gas do	60	54	All to West Germany.
Mineral jelly and wax do	[2]48	[2]26	West Germany 5; Yugoslavia 4.
Petroleum coke do	[2]345	[2]578	Italy 174; Yugoslavia 50.
Bitumen and other residues do	[2]79	[2]51	Austria 16.
Unspecified do	2,724	[2]23	NA.
Total do	50,428	59,663	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	80,334	70,872	Spain 39,777; Italy 15,584; West Germany 6,929.

NA Not available.

[1] Owing to the lack of official trade data published by Romania, this table should not be taken as a complete presentation of Romania's mineral exports. Unless otherwise specified, data are compiled from trade statistics of individual trading partners, as well as the United Nations World Trade Annual, Walker and Co., New York.

[2] Official Romanian trade statistics.

[3] United Nations. Quarterly Bulletin of Steel Statistics for Europe, New York.

Table 3.—Romania: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite	550,842	877,206	Greece 642,073; Yugoslavia 149,664.
Oxide and hydroxide	36,033	25,607	Hungary 18,226; Austria 2,878.
Metal including alloys:			
Unwrought	500	3,490	Hungary 3,437.
Semimanufactures	14,342	6,148	West Germany 2,361; Hungary 2,278.
Cadmium metal including alloys, all forms	72	--	
Chromium:			
Chromite	13,705	2,285	Italy 1,810.
Oxides and hydroxides	--	1	All from France.
Cobalt:			
Oxides and hydroxides	--	5	Do.
Metals including alloys, all forms	12	31	West Germany 21; France 10.
Copper:			
Ore and concentrate	1,248	4,000	All from Morocco.
Metal including alloys:			
Unwrought	33,670	27,129	Zaire 10,000;[3] Poland 5,925; Belgium-Luxembourg 5,449.
Semimanufactures	6,159	10,392	Belgium-Luxembourg 3,071; Poland 2,691; West Germany 1,765.

See footnotes at end of table.

Table 3.—Romania: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Iron and steel:			
Ore and concentrate thousand tons	[3]12,402	[3]13,843	U.S.S.R. 4,373; Brazil 895; Spain 677.
Roasted pyrite	1,116	2,500	All from Italy.
Metal:			
Scrap thousand tons	NA	[4]8	NA.
Pig iron do	[3]646	[3]527	Brazil 105; Australia 33.[5]
Ferroalloys do	[3]160	[3]169	NA.
Steel, primary forms do	28	[4]556	West Germany 76; Poland 21.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	297	[4]854	Poland 84; West Germany 69.
Plates and sheets do	178	[4]377	West Germany 47; Japan 46; Bulgaria 40.
Rails and accessories do	46	[4]70	Yugoslavia 25; Austria 9.
Wire do	13	[4]57	West Germany 11.
Tubes, pipes, fittings do	[3]129	[3]142	West Germany 32; Italy 18.
Castings and forgings do	--	5	Hungary 4; France 1.
Unspecified do	846	--	
Lead:			
Ore and concentrate	4,695	7,420	All from Morocco.
Oxide	5,216	2,002	All from France.
Metal including alloys:			
Unwrought	NA	4,459	Peru 2,009;[6] Italy 2,000.
Semimanufactures	--	1	All from United Kingdom.
Magnesium metal including alloys, all forms	69	27	West Germany 14.
Manganese:			
Ore and concentrate	434	[4]109,000	NA.
Oxides	700	710	Greece 275; Japan 200.
Mercury 76-pound flasks	3,383	5,800	All from Turkey.
Molybdenum metal including alloys, all forms	7	4	West Germany 3.
Nickel metal including alloys:			
Scrap	--	2	All from France.
Unwrought	65	6	All from Netherlands.
Semimanufactures	693	530	West Germany 321; France 118.
Platinum-group and silver metals, unworked or partly worked:			
Platinum-group value, thousands	$3,029	$2,792	France $1,508; United Kingdom $1,055.
Silver do	$311	$359	Switzerland $213; West Germany $73.
Tin metal including alloys, unwrought	2	66	All from United States.
Titanium:			
Oxides	1,000	2,396	Spain 1,280; West Germany 905.
Metal including alloys, all forms	1	--	
Tungsten metal including alloys, all forms	4	7	France 4; United States 2.
Zinc:			
Oxide and peroxide	75	885	Yugoslavia 880.
Metal including alloys:			
Blue powder	1,752	501	All from Italy.
Unwrought	2,000	6,504	Finland 4,507; Canada 1,997.
Semimanufactures	1,156	1,428	West Germany 1,301.
Other:			
Ores and concentrates	237	64,022	Brazil 63,855.
Oxides, hydroxides, peroxides	4	151	Finland 57; France 32.
Metalloids	2,871	12,124	Austria 6,741; Yugoslavia 2,628; France 2,103.
Base metals including alloys, all forms	226	962	Portugal 700; Japan 138.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc	1,592	1,575	Hungary 1,466.
Dust and powder of natural and synthetic precious and semiprecious stones value, thousands	NA	$406	United States $347.
Grinding and polishing wheels and stones	4,800	4,890	Austria 1,360; Yugoslavia 1,308; Italy 1,288.
Asbestos	12,538	11,068	Canada 10,087.
Barite and witherite	3,970	8,857	West Germany 6,120; Thailand 2,000.
Boron: Crude natural borates	NA	30,600	All from Turkey.
Cement	--	12	Belgium-Luxembourg 7.
Chalk	--	254	France 249.
Clays and clay products:			
Crude	21,141	23,411	Czechoslovakia 8,000; Greece 7,900; United Kingdom 4,693.
Products:			
Refractory thousand tons	[3]100	[3]125	Yugoslavia 29; U.S.S.R. 21; West Germany 9.
Nonrefractory	129	108	Italy 91.

See footnotes at end of table.

Table 3.—Romania: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Diamond:			
Gem, not set or strung ..... value, thousands	$3,164	$672	All from United Kingdom.
Industrial ..... do	$846	$1,306	All from Belgium-Luxembourg.
Diatomite and other infusorial earth	1,452	1,292	Iceland 418; France 408; United States 385.
Feldspar and fluorspar	4,103	15,448	Thailand 12,225; Spain 1,533.
Fertilizer material:			
Crude, phosphatic ..... thousand tons	[3]779	[3]879	Morocco 672.
Manufactured:			
Nitrogenous	90	180	All from West Germany.
Phosphatic	14,889	9,757	All from Israel.
Potassic, K_2O content ..... thousand tons	129	162	German Democratic Republic 63.
Other, including mixed	--	149	Belgium-Luxembourg 145.
Graphite, natural	--	73	All from West Germany.
Gypsum and plasters	--	22	Do.
Magnesite	44,181	94,118	Czechoslovakia 89,000.
Mica, all forms	8	19	France 10; Belgium-Luxembourg 5.
Pigments, mineral: Iron oxides, processed	931	1,285	West Germany 999.
Precious and semiprecious stones, excluding diamond value, thousands	--	$18	France $11; Japan $6.
Pyrite	135,711	74,664	All from Yugoslavia.
Salt	--	6	All from West Germany.
Sodium and potassium compounds: Caustic potash	--	276	Yugoslavia 275.
Stone, sand and gravel:			
Dimension stone	47	144	Italy 68; Sweden 57.
Gravel and crushed rock	130	426	France 174; Yugoslavia 127.
Quartz and quartzite	--	553	Sweden 370; West Germany 183.
Sand	--	507	West Germany 505.
Sulfur:			
Elemental:			
Colloidal	214	593	Yugoslavia 244; France 189.
Other than colloidal	122,964	172,408	Poland 172,000.
Sulfuric acid	90,035	14,052	Hungary 7,223; Bulgaria 5,840.
Talc	326	393	All from Italy.
Other:			
Crude	--	1,263	Italy 820; West Germany 307.
Oxides and hydroxides of magnesium, strontium, barium	46	5	United Kingdom 4.
Halogens	21	23	Japan 16; West Germany 6.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	33	Italy 32.
Carbon black	3,992	2,106	Italy 1,503; France 480.
Coal and briquets:			
Anthracite and bituminous ..... thousand tons	[3]3,440	[3]4,669	Czechoslovakia 861; United States 674; Poland 450.
Lignite and lignite briquets ..... do	NA	430	Turkey 245; Yugoslavia 185.
Coke and semicoke ..... do	[3]2,096	[3]2,083	Czechoslovakia 346; West Germany 294.
Petroleum:			
Crude ..... thousand 42-gallon barrels	[3]64,600	[3]94,400	NA.
Refinery products:			
Gasoline ..... do	11	35	West Germany 23; Greece 8.
Kerosine ..... do	18	8	Greece 7.
Distillate fuel oil ..... do	5	23	Greece 22.
Residual fuel oil ..... do	--	12	All from Greece.
Lubricants ..... do	16	20	Netherlands 6; West Germany 5.
Other:			
Liquefied petroleum gas ..... do	--	59	All from Germany.
Mineral jelly and wax ..... do	--	2	West Germany 1.
Unspecified ..... do	5	--	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	11,856	11,469	U.S.S.R. 9,177; France 1,530.

NA Not available.

[1] Owing to the lack of offical trade data published by Romania, this table should not be taken as a complete presentation of Romania's mineral imports. Unless otherwise specified, data are compiled from trade statistics of individual trading partners, as well as the United Nations World Trade Annual, Walker and Co., New York.

[2] World Bureau of Metal Statistics. World Metal Statistics, London.

[3] Official Romanian trade statistics.

[4] United Nations. Quarterly Bulletin of Steel Statistics for Europe, New York.

[5] Australian Government Publishing Service. Australian Mineral Industry Quarterly, Canberra.

[6] Metallgesellschaft AG. Metal Statistics, Frankfurt am Main.

COMMODITY REVIEW

METALS

Aluminum.-Romanian bauxite reserves are estimated at 50 million tons. All of the producing mines are located in the Oradea Area of the northwestern part of the country. Small reserves of low-grade ore have also been reported to exist in the Ohaba-Ponor Area, the central-southwestern part of the country. Domestic production of bauxite is insufficient, and Romania imports over 70% of its requirements, primarily from Greece and Yugoslavia.

Alumina processing capacity of Romania may be over 510,000 tons annually, and in 1978-79 the plants in Tulcea and Oradea operated almost to capacity. Romania imports only about 8% of its alumina consumption. Neither the bauxite, nor alumina are exported. Aluminum metal is produced in Slatina, the only plant in Romania. The plant was expanded and modernized recently, and in 1978 it produced for the first time a high purity aluminum. This development may eventually cut Romania's imports in the future of high purity aluminum. In 1978, the plant also began the manufacture of aluminum tube closures, and developed a new aluminum alloy for the manufacture of roller bearings.

In 1978-79, the overall performance of the Romanian aluminum industry (bauxite, alumina, and aluminum) showed only a slight progress, such as in the utilization of the inferior-quality bauxite ores at Ohaba-Ponor, and the expansion of the Slatina aluminum plant. This stagnation may continue into the forthcoming 5-year plan (1981-85). Bauxite was first mined in the Apuseni Mountains only in 1964, the first alumina produced in Oradea in 1965, and the first aluminum smelted at Slatina in 1965. By 1980 the planned production of primary aluminum and alloys is 265,000 tons. This is to be achieved following the ongoing installation of two additional potlines at the Slatina plant.[9]

Copper.—In 1978-79, Romania mined over 5.5 million tons of ore, averaging about 0.49% copper content. There may be 10 active copper mines, the higher grade ore located in the northern part of the country around Baia Mare and Rosia Montana areas of the Apuseni Mountains, and the lower grade ores located in the Moldova Noua-Rosia Poieni areas in the south. None of the ore is exported, and imports of ore and concentrates are low. Reserves in the north are being depleted rapidly and ores of the newly developed "South Banatian" copper province around Rosia Poieni and Moldova Noua, are only low-grade copper. Those deposits are directly related geologically to the Bor copper province of Yugoslavia. The Moldova Noua deposits are on the same geological trend as the old mining district of Oravita, which produces copper and molybdenun. Stratiform skarn copper deposits have been found on the Stinapari Plateau, not for from the well-known Sacca and Ciclova Montana copper skarn deposits. The recent copper mineralization discoveries of Lapusnicul Mare around Resita and just north of Oravita, also include the Liuoradja, the Moceris, and the Minis Valley mines. The copper there usually occurs as a porphyry skarn, containing a host of other minerals. In the Apuseni Mountains, for example, there are copper-molybdeum and copper-pyrite-gold, and silver porphyries, as well as some lead-zinc deposits.[10] Romania has a joint copper mining venture with Compania Minera Codemin of Chile. Georghe Fulea, Romania's Deputy Minister of Mines, Oil and Geology, visited the Chilean Quimbo copper mine in 1979 to discuss minerals trade and the expansion of mine production.

Romanian production of smelter and refined copper metal remained practically at the same level for a number of years. To supplement domestic consumption, almost 50% of copper metal and products are imported. Romania also exports a significant tonnage of copper metal and alloys. The new Baia-Borsa Mining Enterprise established recently is expected to boost Romania's production of copper in the near future.

Gold.—The estimated production of gold by Romania has remained at the same level for a number of years. No official information or data is available on domestic production, consumption, or trade. In 1978, however, the Romanian State Council issued a decree for a stricter control over the precious metals and semiprecious stones. For example, the use of gold, even in dentistry, must now be planned annually and approved by the State Council. The precious metals covered by the new decree are the same as in the past, including gold, silver, platinum, osmium, ruthenium, rhodium, iridium, and palladium. The number of precious stones, however, was increased by more than 10, among which were included topaz, spinel, amethyst, as well as any stones with a hardness higher than 7 on the Mohs scale. Remaining on the previous list are diamond, ruby, sapphire, emerald, and pearl.[11] The purpose of the new decree is to continuously develop and increase the National Treasure, and to restore goods to state ownership, thus prohibiting the private possession of precious metals and stones, except for personal use.

Gold in Romania is probably still extracted from polymetallic porphyries in the Apuseni Mountains, and from the auriferrous and argentiferrous ores of Baia-Mare. In the Transylvania region, gold is most likely extracted also from alluvial sands.

Iron and Steel.—Production of iron ore did not change significantly in 1978-79. Most of the ore is mined in the Transylvania region, but reserves there are now of inferior quality and are being depleted. Most imports of iron ore come from the Soviet Union and India. For example, only 10% of Galati's iron ore requirement is satisfied by domestic ores. Romania imported also over 1 million tons of roasted pyrite, and exported only a small fraction of it. The only mention by the Romanian press of new iron ore mine development in 1978-79 was that of the Palas-Constanta Mine. The ore is located at a depth of 600 meters in folded strata.

Romania has a well-established iron and steel metallurgical industry, exporting small quantities of pig iron, crude steel, and steel semimanufactures. All crude steel is consumed domestically. Romania imports some pig iron, semimanufactures, crude steel, and ferroalloys.

The Galati iron and steel complex is the largest in Romania. Other major iron and steel works are the Hunedoara, Calarasi, and the Resita Complex. Romania is striving to expand and upgrade its steel production, and in 1979, 75,000 tons of stainless steel was produced. To date, Romania has not produced any ferroalloys, importing most of them from the Soviet Union, Poland, and Norway. By 1980, Romania plans to produce over 13% of alloyed steel and 52% of high-quality steel. The share of steel produced by oxygen converters is to increase to 44.2% in 1980, while the open hearth is to decrease to 37.5%; electric furnaces will constitute about 18%.[12]

In 1979, construction of a wire and a medium profile rolling mill started at Focsani in Vrancea County, approximately 70 kilometers northwest from the Galati iron and steel complex. Another wire rolling mill was under construction at Beclean in Bistita-Nasaud County, about 70 kilometers southwest of Baia-Mare. With the ongoing modernization of the Galati iron and steel enterprise, and a planned crude steel capacity in 1980 of 10 million tons, Romania expects to produce a total of 15.6 million tons of crude steel in 1980. Another developing aspect of the Romanian metallurgical industry, was the high investment in the special steel complex designed to produce Romanian-brand stainless steel sheets by the name of "Otelinox." After Galati, Tirgoviste (part of the Resita Complex) is the most important project of the Romanian iron and steel industry. By the end of the second construction stage in 1980, the production of crude steel is expected to reach a capacity of 1 million tons. The Calarasi is the newest Romanian steel works project, slated for full operation in 1981.[13] Reportedly, the first batch of steel at Calarasi in an electric furnace was produced in November 1979. According to reports, the steel output of Calarasi is to be nearly 2 million tons by 1985, and 10 million tons by 1990. Thus, the long-term crude steel plans include the expansion of domestic production to over 25 million tons by 1990, increased exports, and a decrease in imports.

Lead and Zinc.—Romania, in its 1979 annual statistics yearbook, published the production of lead and zinc for the first time.[14] The output of lead and zinc metal has been stable since 1970, with minor yearly fluctuations. In 1978-79 about 5 million tons of lead and zinc ore was processed each year, with approximately 0.67% lead and 1.20% zinc metal content. Romania also imports small amounts of lead ore and concentrate, lead and zinc oxides, and finished metal, depending on the yearly requirements. The entire output is consumed domestically.

NONMETALS

Cement.—Romania is self-sufficient in cement production. About 12 cement plants scattered throughout the country are increasing production steadily for a domestic consumption of over 11 million tons. The recently completed Tasca cement plant in Neamt County, the Moldavian Carpathians, is the largest and most efficient in Romania. It is planned to increase production capacity of the Romanian plants up to over 20 million tons by 1980.

To cut its energy consumption, Romania is attempting to curb and streamline its output of energy-intensive products. The research in the use of tuff as an admixture in cement is one such attempt. Romanian reserves of tuff amount to thousands of millions of tons, located primarily in Slanic, Vilcea, and Persani areas. Other smaller deposits occur in Salaj, Cluj, Bistrita-Nasaud, Vilcea, Ara-Severin, and Constanta Counties, providing raw materials for the construction industry. Reportedly a new technology has been developed and a plant designed for the production of cellular concrete from tuffs. In addition, the old wet-processing method is now being replaced by the dry-processing method in many of the Romanian plants, including various other energy-saving measures. In addition to the Tasca-Bicaz, the Deva cement plant was also nearing completion in 1978.[15]

Fertilizer Materials.—During the current 5-year plan, Romania has been steadly increasing the output of its manufactured fertilizers except for a slight decline in 1978. Romania manufactures all of its nitrogenous fertilizer, and exports over 50% of it worldwide. All of the crude phosphate and apatite concentrate, and manufactured phosphatic fertilizer, are imported for domestic consumption. Romania also imports all of its requirements for the manufactured potassic fertilizer. The approximate consumption of chemical fertilizers in 1978-79 may have reached over 1.5 million tons of active substances annually. Phosphate rock and potassic fertilizers are imported from Israel, the U.S.S.R., the United States, Morocco, Syria, Algeria, Jordan, the Democratic Republic of Germany, and the Federal Republic of Germany. Exports of nitrogenous fertilizer and ammonia are directed to the market economy and other countries throughout the world.

According to published reports of the COMECON countries, a Romania is second only to the Soviet Union in terms of numbers of chemical plants on hand. Romania also maintains a second position after the Soviet Union in the fertilizer industry, with a total capacity of 1,650,000 tons of ammonia and 1,269,000 tons of urea annually.

The 1980 plan envisages a production increase in the chemical industry in general, with an output of almost 4 million tons of fertilizers. In additiion to the newly expanded Turnu Magurele plant, the fertilizer combines at Bacau and Slobozia were reportedly also planned for expansion in 1980.

The production capacity of the Romanian fertilizer and chemical plants is summarized in the table below:

Plant Location	Product	Capacity (tons per year)
Arad	Ammonia	300,000
	Complex fertilizer	891,000
	Diammonium phosphate.	17,000
	Nitric acid	450,000
	Urea	420,000
Bacau (relocated from Tecuci).	Ammonia	300,000
	Complex fertilizer	891,000
	Nitric acid	450,000
	Urea	420,000
Craiova	Ammonia	300,000
	Complex fertilizer	891,000
Navodari	Phosphoric acid	20,000
	Superphosphates (single and triple).	600,000
Piatra Neamt	Azot No. 4 plant nitrogen.	140,000
	Urea	1,000
Slobozia	Urea	420,000
Tirgu Mures	Complex fertilizer plant.	891,000
	Ammonia plant (3)	300,000
Turnu Magurele	Complex fertilizer	891,000

Sand and Gravel and Stone.—In 1979, the Romanian Ministry of Mines, Oil and Geology undertook a country-wide sand and gravel and building stone reserves mapping and exploration program. An effort was made to locate the reserves for eventual mining and transport to areas of need. Thus, for example, the granite in northwestern Dobruja region could meet all the needs of the eastern Wallachia and Southern Moldavia. The known undepleted sand and gravel quarries were planned for expansion (such as Taul Rosu, Cicirlau-Maramures, and Suseni-Harghita), and new reserves were mapped (Zam-Hunedoara, Piatra, Tisei-Maramures and Tarcau-Piriul Caprei-Bacau). In the southern Moldavia, Wallachia, and Oltenia regions, sand and gravel are localized to the Danube River Valley and its tributaries, such as the Siret, Buzau, Prahova, Arges, Otr, Mures, and Somes. The Ministry also planned to examine the utilization of sand and gravel overlying the coal beds in Oltenia. Reserves of commercially usable limestone have been mapped in Dobruja and Oltenia; of scoria in the Racosul de Jos-Valea Bogatii zone; of volcanic tuff in the Transylvania region (Vilcea, Prahova, and Bacau Counties); diatomite in Patirlagele, Adamclisi, Filia, and Minis; and perlite in the Orasu Nou zone, to name only the most important reserves. The Ministry stressed that for the sake of energy conservation, those reserves located closest to the existing transportation facilities to be used first. The table below summarizes the reserves compiled for some of the building materials.[16]

Building materials	Usable reserves		Annual consumption	Supply of reserves (years)		Number of deposits	
	Total	Percent now in use		Total	Now in use	Total	Now in use
Hard rocks (mostly granite, crushed) thousand tons	1,707,283	62.3	24,365	70	44	171	120
Ornamentals do	52,054	37.9	218	238	91	55	27
Sand and gravel thousand cubic meters	1,114,803	47.3	27,409	41	19	204	110
Scoria, tuff, diatomite thousand tons	25,235	14.8	398	634	94	10	5
Perlite, dacite do	2,052	0.8	4	513	38	12	3
Limestone (for cement) do	757,824	69.5	6,954	109	76	162	104
Miscellaneous rocks do	3,816,350	71.6	35,655	107	77	85	42

Sulfur.—All of Romania's sulfur is produced from pyrite and as a byproduct of oil processing. Romania mines some of its own pyrite, but large quantities of roasted pyrite are imported from Italy. Elemental sulfur is also imported mostly from Poland, and sulfuric acid from the German Democratic Republic and Hungary. An insignificant quantity of roasted pyrite is exported, much of it to Hungary. All of the sulfur and acid, however, are used domestically, with the consumption of sulfur growing steadily.

Most of Romania's cupreous and auriferous pyrite reserves are located in the Carpathians and in Transylvania, with some of the cupreous pyrites also occurring in the northern Dobruja region in the southeast. Reportedly, a new mining facility was put into operation at Calimani in 1979 for the mining there of the newly discovered sulfur-bearing ores.

MINERAL FUELS

Romania's primary sources of energy in 1978-79 were petroleum, natural gas, and hydropower. While the 1980 energy policy was being developed, the energy situation in 1978 worsened; Romania in 1979 did not meet its target for the production of crude oil, and was facing severe supply and price problems in crude oil imports. Even though Romania's reserves of coal and natural gas are substantial, the output of natural gas was being leveled off, and coal production grew considerably less than planned.

Romania, however, began to attach high priority to development of its electric power sector which it considers to be a prerequisite for the overall economic development of the country. The largest hydroelectric generation facilities in Romania are located on the Danube River: "Iron Gates I" and "Iron Gates II," constructed in cooperation with Yugoslavia and the Soviet Union, and "Turun Magurele" station built in cooperation with Bulgaria. The current energy policy is aimed at directing Romania's gas reserves increasingly for use as feedstock in the chemical industry, while additional power generation is to be based on low-grade domestic solid mineral fuels such as lignite and shale, and on hydro and nuclear power.

Overall, Romania consumes two to three times more power per unit of output than many of the industrialized countries, simply through excessive or inefficient usage. The ferrous and nonferrous industry, for instance, consumes about 28% more energy than France and 14% more than Sweden. The chemical industry consumes four times more than France and five times more than Sweden.[17] Industry uses over 70% of the total primary energy resources. The metallurgical industry used almost 24% and the chemical industry 35% of the primay energy in 1978-79. During the next decade, however, the industry has been directed to cut the consumption of power to 40%. To achieve energy self-sufficiency by the end of the next decade. President Ceausescu, in 1979, called for a gradual reduction of oil and other fuel imports, for the promotion of the less energy-intensive industrial branches, for energy conservation in general, for a more intense search for domestic oil, gas, and coal reserves, and for the elevation of oil extraction above its present rate of some 25% to 30%. It is estimated that at present, Romania's energy self-sufficiency stands at about 75%.

To broaden its base for hydrocarbon supply, Romania in 1978-79 continued to seek international participation in geological research, oil drilling projects, and joint ventures. In addition, Romania provided oil drilling equipment and personnel for the exploration and construction of refineries abroad.

Virgil Trofin, Minister of Energy, speaking at the 12th Congress of the Romanian Communist Party in Bucharest on November 20, 1979, reported that Romania's installed total power at present is almost 15,000 megawatts, and that 25 new power stations were commissioned during the current 5-year plan, of which 6 were fueled by coal. In 1980, hydroelectricity is to account for almost 18%, and hydrocarbons and coal is to account for 40% each of total produced power, with over 2% being contributed by solar power. According to some reports, by 2000 Romania will also become one of the most important markets in Eastern Europe for equipment and research projects dealing with solar energy.[18]

The total Romanian primary energy balances for 1978-79 are shown in the following table:

Romania: Total primary energy balance for 1978-79

(Million tons of standard coal equivalent)[1]

Year	Total primary energy	Coal lignite, anthracite, bituminous, coke	Crude oil and petroleum products	Natural and associated gas	Hydropower, etc.
1978:[2]					
Apparent consumption	83.3	17.8	22.7	41.8	1.0
Exports	10.9	--	10.3	.3	.1
Imports	18.5	5.7	12.7	--	.1
Production	75.7	12.1	20.3	42.1	1.2
1979:[2]					
Apparent consumption	83.8	20.1	20.4	42.2	1.1
Exports	11.3	--	10.7	.3	.1
Imports	19.0	5.9	13.0	--	.1
Production	76.1	14.2	18.1	42.5	1.1

[1] 1 ton of standard coal equivalent (SEC)=7,000,000 kilocalories. Coversion factors used are: hard coal, 1.0; lignite and brown coal, 0.33; coke, 09; crude oil, 1.47; natural gas, 1.33 (per 1,000 cubic meters); hydroelectric power, 0.123 (per 1,000 kilowatt-hours).

[2] Production-production table.

Coal.—In 1979, Romania reported the production of run-of-mine and washed coal, and also the output of coke. During 1978-79, Romania, however, did not reach its planned production goal.

In 1978-79, lignite accounted for 75% of total coal by tonnage, mined mostly in the Southern Carpathians, near Tirgu Jiu. The 25% or so of the anthracite and bituminous coals come from the Valea Jiului (Jiu Valley), in the Oltenia Region. Romania possesses adequate reserves of lignite, primarily used for the generation of electric power. Total coal reserves in Romania are estimated at 3,000 to 4,500 million tons. Although lignite is able to meet electric power generation requirements, coking coals continued to be imported for the metallurgical industry.

Reportedly, over 600,000 tons of metallurgical-grade coal was purchased by Romania from Canada's Kaiser Resources Ltd. in 1978. A joint agreement for the development of metallurgical coal reserves in British Columbia at Quintette (Denison Mines) was signed with Canada in 1978. Romania plans to purchase about 1.5 million tons annually of metallurgical coal over the next 20 years from the Denison Mines. Delivery may start in 1982 at the rate of about 1.4 million tons annually, and Romania expressed an interest in acquiring a 10% equity in the project.

In 1979, in addition to existing import of bituminous coal from Canada, Romania finalized its purchase agreement of 400,000 tons annually of coal from the Occidental Petroleum Co.'s subsidiary, Island Creek Coal Co. in Virginia. Additional Island Creek exports may start in 1980, initially at 500,000 metric tons. Romania also imports coal from the Democratic Republic of Germany, the Federal Republic of Germany, India, and the Soviet Union, and in the future may purchase coal from Australia.

Natural Gas.—According to Romanian plans, the production of natural gas in 1978-79 decreased from 1977, and has been leveled off in lieu of increased usage of coal as the primary energy source. Furthermore, in 1979 Romania began receiving gas from the Soviet Union through the completed Orenburg pipeline. Deliveries in 1979 by this pipeline were to total 0.8 billion cubic meters and are to increase to 1.5 billion cubic meters annually during the 1981-85 period. Although Romania's participation in the Orenburg project was somewhat less than that of other COMECON countries, the amount of gas that will be received as payment is significant, representing about 2.8% and 5.2%, respectively, of total Romanian gas production in 1979 and 1980. Romania exports a small amount of gas, mainly to Hungary. Natural gas remained Romania's most important source of primary energy production. In 1978, natural gas supplied about 50% of all electrical power produced in Romania.

The Romanian natural gasfields are over 95% pure methane, with a high heating rate. The Romanian upcoming 1981-85 5-year plan provides for a decrease in the production of methane gas to about 26.5 billion cubic meters annually by 1985. Most of Romania's reserves of natural gas are concentrated in the northwest, in the Ardeal region. Depending on sources, Romania's gas reserves are estimated to suffice for the next 10 to 20 years, at present production rates.

In addition to the newly built Orenburg gas pipeline, a pipeline feeding gas from the Soviet Union to Bulgaria already crosses Romania near its Black Sea coast. One of the Soviet's 1979 top-proirity projects was the construction of a new gas pipeline from the Shebelinka gasfield in the Ukraine to Izmail on the Soviet-Romanian border. Soviet gas deliveries are guaranteed to 1990, with an optional extension for a further 10-year period.

Petroleum.—Romania is the only significant producer of crude oil in Eastern Europe. It did not meet its goals for crude oil production, targeted at 15.1 million tons for 1978, and 14.8 million tons for 1979. In 1979 Romania imported over 50% of its crude oil requirements for domestic consumption and for export of petroleum products, on which the country's economy depends heavily. According to some reports, exports of petroleum and petroleum products represented 9% of the total exports and 14% of the total imports in 1978. Romania also participated in various cooperation projects in the petroleum sector with partners in more than 20 countries, the majority being developing countries, to insure Romania's future petroleum needs. Reportedly, Romania in 1978 imported several million tons of Iranian oil, and has been negotiating for alternative supplies from Algeria, Libya, China, Indonesia, Venezuela, Mexico, Nigeria, and Middle Eastern countries such as Iran, Iraq, and Kuwait.

One of the basic objectives of President Ceausescu's April 8-25, 1979 tour of eight African countries was to look for assured supplies of vital raw materials for Romania, most importantly oil and gas.[19] In addition to the official visits to oil-producing States, Romania in 1979 hosted the World Petroleum Congress. The congress provided another occasion for discusions with oil companies and representatives of oil-producing States about the supply problem.[20]

Romania is the only COMECON country that does not import oil from the Soviet Union. Some reports indicate, however, that Romania approached the Soviet Union for crude shipments in 1979. Those purchases would be initially small and without any long-term commitments by either side.

In 1979, President Ceausescu called for gradual reduction of imports of oil and other fuels so that self-sufficiency could be reached by the end of the next decade. To achieve this goal, a number of measures have been recommended including the search for domestic oil, gas, and coal reserves, and to raise the degree of oil extraction above its present rate of about 32%. According to Vasile Patilinet, Minister of Mines, Oil, and Geology, the recovery factor will rise to 37% in 1986, and to approximately 40% in the 1990-2000 period.[21]

In line with the program of energy self-sufficiency, of major importance in 1979 was the announced discovery of oil in the Black Sea, off the Romanian coast, by the Gloria drilling platform. Reserves and production are as yet undetermined. Another Romanian-built off-shore oil platform, Former 2, was being built in 1979 at the 1 May Works in Ploiesti. Once completed it will be sent to Galati and then will join the Gloria platform in the Black Sea.

Domestic production of refined products was interrupted in 1978, by an explosion at the Pitesti oil refinery. During the night of October 30-31, an explosion in the catalytic cracking unit caused a fire that killed nine people and injured others, and a number of installations were put out of action. The Pitesti oil refinery is part of a massive petrochemical complex that is comprised of 96 different plants, employing about 9,000 workers. The Pitesti refinery reportedly processes exclusively imported rather than domestic crude.

Negotiations were reportedly underway in 1979 between Romania and Nigeria for the continuation of construction of an oil refinery at Media-Navodari on the Black Sea coast, a project that had been delayed after negotiations with Kuwait stalled in 1978. Nigeria will eventaully supply the crude oil for the refinery. Part of the new refinery, which is specifically designed for export purposes, went onstream in 1979. The planned annual capacity of the completed Navodari refinery of 3.5 million tons is to be reached in 1982.

In 1979, a 3.5-million-ton annual capacity unit was also added to the existing Borzesti refinery. Reportedly, a total of 15 new petrochemical units were planned to be put into operation during the 1976-80 5-year plan.

Nuclear Power.—Romania continued to plan the development of its nuclear industry. In 1978, an agreement was signed with Canada for the purchase of four 600-megawatt CANDU reactors using natural uranium. The 1978 agreement was part of a plan that would eventually provide for up to 16 nuclear plants by 1990. Some of the 16 planned reactors are to be built entirely by Canada, and some by Romania under a license. The first complex of four units to be constructed in the southeastern part of the country (Olt and Cernavada) is expected to go on-line in 1985. This was the first sale of a Canadian nuclear reactor to a centrally planned economy country. Romania has also purchased a nuclear reactor from the Soviet Union with a 440-megawatt capacity for a power station that is to be completed by 1983. According to Romania's long-term plan, the power station will represent a 5.5% share in total power production in 1985 and 20% in 1990.

Reportedly, Romania in 1979 concluded a 3-year contract with Gabon providing for annual deliveries of 100 to 150 tons of uranium beginning in 1986. Romanian uranium mines will not be able to supply the needed nuclear fuel. According to some estimates, Romania has 10,000 to 20,000 tons of reasonably assured uranium reserves, and an additional 20,000 to 50,000 tons of estimated reserves. Romania's estimated annual production of uranium was 1,000 tons in 1978.

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[1] Physical scientist, Branch of Foreign Data.

[2] Official exchange rate (lei4.47=US$1.00), tourist rate (lei12=US$1.00), and trading rate (lei18=US$1.00).

[3] Revista Economica (Economy Review), Bucharest. No. 45, Nov. 10, 1978, pp. 1-3; No. 52, Dec. 29, 1978, pp. 6-7, 12; No. 35, Aug. 31, 1979, pp. 4-6.

Scinteia, Bucharest. Nov. 4, 1978, pp. 5-6; Feb. 2, 1979, pp. 1-2; Feb. 7, 1980, pp. 1, 3.

Revista de Statistica (Statistics Review), Bucharest. Feb. 2, 1979, pp. 1-14.

[4] COMECON (also referred to as CEMA or CMEA) - The Council for Mutual Economic Assistance; an organization of 10 countries involved in economic cooperation and coordination, comprising in 1979; Bulgaria, Cuba, Czechoslovakia, the German Democratic Republic, Hungary, Mongolia, Poland, Romania, the U.S.S.R., and Vietnam. Yugoslavia obtained a permanent observer status in 1965.

[5] Revista Economica (Economy Review), Bucharest. No. 29, July 20, 1979, p. 1-8.

Romanian Foreign Trade, Bucharest. January 1980, pp. 2-7.

[6] Revista Economica (Economy Review), Bucharest. No. 36, Sept. 7, 1979, pp. 7-8; No. 38, Sept. 21, 1979, pp. 5-6; No. 39, Sept. 28, 1979, pp. 8-9; No. 42, 19, 1979, pp. 4-6, 7.

[7] Buletinul Oficial (Official Bulletin), Bucharest. P. 1, No. 39, Apr. 12, 1979, pp. 2-3.

[8] Second work cited in footnote 5, p. 16.

[9] Romanian Foreign Trade, Bucharest. February 1979, pp. 19-22.

[10] World Mining, San Francisco. January 1980, pp. 53-55.

[11] Buletinul Oficial (Official Bulletin), Bucharest. No. 61, July 15, 1978.

[12] Revista Economica (Economy Review), Bucharest. No. 32, Aug. 10, 1979, p. 10-11.

[13] Metal Bulletin Monthly, London. January 1979, pp. 33-35.

Romanian News, Bucharest. Jan. 18-25, 1980, p. 4.

Work cited in footnote 9, pp. 12-18.

[14] Anuarul Statistic al Republicii Socialiste Romania 1979 (Annual Statistics of the Socialist Republic of Romania), Bucharest. 1979, p. 179.

[15] Revista Economica (Economy Review), Bucharest. No. 26, June 30, 1978, pp. 5-6.

[16] Revista Economica (Economy Review), Bucharest. No. 37, Sept. 14, 1979, pp. 11, 14-15.

[17] Scinteia, Bucharest. Aug. 3, 1979, p. 1.

Ekra Socialista (Socialist Era), Bucharest. No. 8, Apr. 20, 1979, pp. 22-25, 58.

[18] Revista Economica (Economy Review), Bucharest. No. 40, Oct. 5, 1979, pp. 1-2; No. 47, Nov. 24, 1979, pp. 11-12.

Era Socialista (Socialist Era), Bucharest. No. 18, Sept. 20, 1979, pp. 15-18.

[19] Romania Libera (Free Romania), Bucharest. Apr. 1, 1979, p. 3.

Scinteia, Bucharest. Apr. 28, 1979, p. 5.

[20] Mine, Petro si Gas (Mines, Oil and Gas), Bucharest. No. 10, 1979, pp. 481-484.

Romanian Foreign Trade, Bucharest. Oct. 4, 1979, p. 1.

[21] Scinteia, Bucharest. Oct. 4, 1979, p. 1.

Revista Economica (Economy Review), Bucharest. No. 35, Aug. 31, 1979, pp.. 4-6; No. 41, Oct. 12, 1979, pp. 11-12.

The Mineral Industry of Saudi Arabia

By Candice Stevens[1] and W. Thomas Cocke[2]

Increased oil revenues accounted for the rapid growth of Saudi Arabia's gross national product (GNP), from $5 billion[3] in 1970 to $63 billion in 1978 and to an estimated $76 billion in 1979. The contribution of the petroleum sector to the GNP had risen to about 60% by 1979. However, diversification of the economy was a top priority of the Government in the late 1970's, and large investments were made in nonpetroleum enterprises. Nonfuel minerals production was mainly for construction and industrial uses, and mineral exploration continued at a high level by both the Government and a number of foreign firms.

Two new industrial centers, Jubail on the east coast and Yanbu on the west coast, were the focus of the Government's development efforts during 1978 and 1979. By the end of 1979, $4 billion had been committed for 275 contracts for Jubail, with emphasis on creation of an infrastructure. The expansion project to raise the handling capacity of Yanbu Port to 2.7 million tons per year was completed at a cost of $340 million. The 1978-79 and 1979-80 budgets ($38 billion and $47 billion respectively) were largely devoted to finishing projects begun under the second 5-Year Development Plan (1975-79) and efforts to reduce Government expenditures and control inflation. The third 5-Year Development Plan (1980-84), with a projected budget of more than $250 billion, was expected to focus less on infrastructure development and more on industrial projects and development of human resources.

In January 1978, the Government issued new requirements for foreign investors. Saudi Arabia invited foreign and national private investment in mineral enterprises, but retained an option to acquire up to 50% interest in any such venture. Other provisions required foreign firms to have a Saudi agent or partner, limited the issuance of visas for dependents to highly skilled workers, gave preference to projects with the fewest possible employees, and required foreign contractors with more than 100 employees to provide their own housing. Housing shortages, port congestion, and staggering rates of inflation caused by the 1975-76 oil boom, were relieved by energetic Government efforts begun in 1977.

PRODUCTION

Saudi Arabia's petroleum production decreased in 1978 owing to lowered production ceilings and weak work demand, but remained second only to that of the U.S.S.R. In 1979, however, production was near record high levels, as a result of a temporary increase in the production ceiling for most of the year. The temporary increase lifted the ceiling to 9.5 million barrels per day and was effected in response to disruptions in the supply of oil from Iran. Total oil receipts were down in 1978, but rose sharply in 1979.

The Arabian American Oil Co. (Aramco) was the sole producer of oil in Saudi Arabia, except for the production shared with Kuwait in the partitioned Neutral Zone. Total oil and natural gas liquids (NGL) production in 1979 was nearly 10 million barrels per day. In December 1978, the Organization of Petroleum Exporting Countries (OPEC) decided to raise prices in quarterly increments that would have totaled 14.5%

over the course of 1979, but by December 1979, prices for Arabian light crude were $24 per barrel, or nearly double the December 1978 price. Aramco reported proven petroleum reserves of 113 billion barrels and proven plus probable reserves of 178 billion barrels. Petroleum reserves in the Neutral Zone were estimated at 3.5 billion barrels. By the end of 1979, Saudi Arabia's oil-producing capacity had risen to nearly 11 million barrels per day.

The Ras Tanura facility, operated by Aramco, was Saudi Arabia's largest producer of petroleum products and NGL, and the facility's production of these products rose sharply during 1978 and 1979. Production of cement and fertilizers also rose sharply during this period owing to the expansion of facilities. Saudi Arabia also produced small quantities of other nonmetallic minerals. Mineral production for 1978 and 1979 is shown in Table 1.

Table 1.—Saudi Arabia: Production of mineral commodities

Commodity and unit of measure	1976	1977	1978ᵖ	1979ᵉ
METALS				
Iron and steel: Crude steel thousand metric tons	ʳ5	ʳ5	5	5
NONMETALS				
Cement, hydraulic[1] do	1,104	1,267	1,800	2,200
Gypsum do	17	20	210	300
Lime[e] do	15	20	30	35
Nitrogen, N content of ammonia do	102,000	125,000	140,000	145,000
Sulfur:				
Native metric tons	1,326	1,160	1,083	1,100
Byproduct, all sources do	12,000	12,000	14,000	14,000
Total do	13,326	13,160	15,083	15,100
MINERAL FUELS AND RELATED MATERIALS[2]				
Gas, natural:				
Gross million cubic feet	1,667,904	1,719,816	1,544,960	1,700,000
Marketed[e] do	138,327	158,915	334,927	400,000
Natural gas liquids:				
Propane and butane thousand 42-gallon barrels	46,748	NA	NA	NA
Natural gasoline and other do	19,665	NA	NA	NA
Total do	66,413	70,000	91,009	100,000
Petroleum:				
Crude do	3,139,722	3,357,955	3,029,901	3,350,000
Refinery products:				
Gasoline do	9,545	12,334	13,295	13,000
Jet fuel do	4,346	2,054	202	200
Kerosine do	8,535	8,569	9,854	10,000
Distillate fuel oil do	26,914	32,116	37,486	37,500
Residual fuel oil do	104,528	96,887	95,006	95,000
Other:				
Liquefied petroleum gas do	47,021	57,571	65,326	65,500
Naphtha do	51,491	50,651	55,881	56,000
Asphalt do	5,081	7,063	6,178	6,200
Unspecified do	--	--	1,085	1,100
Refinery fuel and losses do	9,499	9,608	ᵉ10,200	10,200
Total do	266,960	276,858	294,513	295,000

ᵉEstimate. ᵖPreliminary. ʳRevised. NA Not available.
[1] Data are for the Hejra calendar year, which corresponds closely to the Gregorian calendar year.
[2] Includes Saudi Arabia's 1/2 share of production in the Kuwait-Saudi Arabia Partitioned Zone.

TRADE

Saudi Arabia's balance-of-trade surplus decreased in 1978 for the first time in several years. Decreasing oil revenues and increasing imports of goods and services combined to reduce the large trade surplus, but in 1979, the upward trend returned and petroleum receipts rose rapidly.

Saudi Arabia is the world's largest exporter of petroleum. The main recipients of Saudi crude oil were Western European countries, Japan, and the United States. The country also exported refined petroleum products and was the world's largest exporter of NGL, which was exported principally to Japan and Western Europe.

The Government embarked on a massive port-expansion program to relieve congestion at the country's crowded terminals

The large port of Damman on the east coast was scheduled to be modernized and expanded to handle larger oil tankers. New commercial ports were under construction at Jubail and Yanbu to handle general and industrial bulk cargo and liquid products. Hyundai Construction Co. Ltd. (Republic of Korea) was contracted for work at Jubail Port and Frederic R. Harris Inc. (United States) was designated master planner for Yanbu Port. Construction by Fluor Corp. (United States) proceeded on the Ju'aymah terminal, which was expected to be the world's largest NGL export facility.

Table 2.—Saudi Arabia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978
METALS	
Aluminum metal including alloys, all forms	1,455
Copper metal including alloys, all forms	1,584
Iron and steel metal:	
Scrap	110
Semimanufactures:	
Bars, rods, angles, shapes, sections	379
Plates and sheets	72
Tubes, pipes, fittings	464
Castings and forgings	133
Zinc metal including alloys, all forms	124
NONMETALS	
Abrasives: Pumice, emery, natural corundum	16,292
Fertilizer materials:	
Crude:	
Nitrogenous	92,093
Other	578
Manufactured, mixed	310
Gypsum and plasters	2,912
Lime	996
Pigments, mineral, including processed iron oxides	166
Salt and brine	3,597
Sodium and potassium compounds, n.e.s	204
Stone, sand and gravel:	
Dimension stone:	
Crude and partly worked	59,474
Worked	4,842
Gravel and crushed rock	54,366
Other	75
Sulfur, elemental, all forms	3,697
Other: Building materials of asphalt, asbestos, and fiber cement, including unfired clay brick	355
MINERAL FUELS AND RELATED MATERIALS	
Petroleum:	
Crude and partly refined thousand 42-gallon barrels	2,819,359
Refinery products:	
Gasoline do.	42,979
Kerosine and jet fuel do.	1
Distillate fuel oil do.	1,005
Residual fuel oil do.	4,328
Lubricants do.	13
Other do.	122,239
Total do.	170,565

Table 3.—Saudi Arabia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978
METALS	
Aluminum:	
Oxide and hydroxide	202
Metal including alloys, all forms	25,279
Copper metal including alloys, all forms	5,718
Iron and steel metal:	
Scrap	757
Pig iron, ferroalloys, similar materials	12,069
Steel, primary forms[1]	17,086

See footnotes at end of table.

Table 3.—Saudi Arabia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978
METALS —Continued	
Iron and steel metal —Continued	
Semimanufactures:	
Bars, rods, angles, shapes, sections	735,715
Plates and sheets	179,292
Hoop and strip	20,098
Rails and accessories	8,965
Wire	8,060
Tubes, pipes, fittings[2]	416,250
Castings and forgings	64,390
Lead:	
Oxide	181
Metal including alloys, all forms	1,899
Nickel metal including alloys, all forms	277
Platinum-group and silver metals including alloys:	
Platinum-group troy ounces	4,581
Silver do.	2,818,476
Tin metal including alloys, all forms	132
Titanium oxide	1,155
Tungsten metal including alloys, all forms	18
Zinc:	
Oxide	968
Metal including alloys, all forms	8,908
Other:	
Ores and concentrates	222
Oxides, hydroxides, peroxides of metals	628
Metals including alloys, all forms:	
Alkali, alkaline-earth, rare-earth metals	492
Pyrophoric alloys	46
NONMETALS	
Abrasives:	
Pumice, emery, natural corundum	4,987
Grinding and polishing wheels and stones	1,298
Asbestos	6,580
Barite and witherite	3,512
Cement	6,772,434
Chalk	3,109
Clays and clay products:	
Crude	15,746
Products, refractory and nonrefractory	228,085
Diatomite and other infusorial earth	2,461
Fertilizer materials:	
Crude:	
Nitrogenous	10,588
Phosphatic	603
Potassic	318
Other	1,473
Manufactured:	
Phosphatic	16,749
Potassic	4,894
Mixed	2,980
Ammonia	1,311
Gypsum and plasters	20,784
Lime	139,242
Magnesite	60
Mica:	
Crude	270
Worked, including agglomerated splittings	73
Pigments, mineral, including processed iron oxides	3,765
Salt and brines	13,860
Sodium and potassium compounds	4,169
Stone, sand and gravel:	
Dimension stone:	
Crude and partly worked:	
Calcareous	11,687
Other	5,908
Worked:	
Slate	6,518
Paving and flagstone	127,913
Other	64,589
Dolomite	440
Gravel and crushed rock	89,530
Sand, excluding metal bearing	909
Other	1,139
Sulfur:	
Elemental, all forms	1,132
Sulfur dioxide	851
Sulfuric acid	1,555
Other: Building materials of asphalt, asbestos, and fiber cement, including unfired clay brick	178,159

See footnotes at end of table.

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Table 3.—Saudi Arabia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978
MINERAL FUELS AND RELATED MATERIALS	
Asphalt and bitumen, natural	2,118
Carbon black and gas carbon	68
Coal and coke, including briquets	2,082
Hydrogen, helium, rare gases	90
Peat	378
Petroleum:	
Crude and partly refined ... thousand 42-gallon barrels	43
Refinery products:	
Gasoline ... do	5
Kerosine and jet fuel ... do	8
Distillate fuel oil ... do	30
Residual fuel oil ... do	22
Lubricants ... do	927
Other ... do	1,214
Total ... do	2,206
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	3,977

[1] May include some unspecified semimanufactures.

[2] Includes blanks for pipes and tubes.

COMMODITY REVIEW

METALS

Exploration for metallic minerals on the Arabian Shield continued by a number of foreign companies under licenses granted by the Directorate General of Mineral Resources (DGMR). The French Bureau de Recherches Geologiques at Minieres (BRGM) continued its general exploration program in central Saudi Arabia. Investigation of mineral deposits in western Saudi Arabia was being conducted by the U.S. Geological Survey (USGS). Hunting Surveys Ltd. (United Kingdom) proceeded with the surveying and mapping of Eastern Province. Rio Tinto Finance & Exploration Ltd. (Riofinex), a subsidiary of Rio Tinto-Zinc Corp. Ltd. (United Kingdom), was providing an overall feasibility study on the exploitation of Saudi Arabia's mineral deposits under a 5-year contract.

In 1978, Utah International Inc. (United States) was awarded an exploration concession in the Wadi Ablah area of the Arabian Shield. The prospecting focus was expected to be on copper, lead, zinc, and gold mineralization. Fairey Surveys (United Kingdom) was awarded a $2 million contract for the preparation of geologic maps covering a 110,000-square-kilometer area of the Arabian Shield.

In 1979, Arabian Geophysical and Surveying Co. (ARGAS) was awarded a $27 million contract for mapping 400,000 square kilometers of Rub Al-Khali in the southeastern desert area of Saudi Arabia. ARGAS is 51% owned by the General Petroleum and Mineral Organization (Petromin) and 49% owned by French Cie General de Geophysique.

The 60-square-kilometer Atlantis II Deep Basin area was selected by the Saudi-Sudanese Commission for the Exploration of Red Sea Resources for the site of a pilot mining project to recover metal-bearing sediments from the Red Sea floor. In 1978, the U.S. research vessel Melville conducted a program of geological and geophysical surveys in an area of the Atlantis II Deep Basin that was estimated to contain seabed deposits of zinc, copper, silver, and other materials valued at $3.5 billion. In 1979, a mining system consisting of a vibrating suction sieve and a series of hydraulic pumps was developed and tested by Orenstein and Koppel AG, working under a contract to Preussag AG (both Federal Republic of Germany). About 3,500 cubic meters of material was recovered and stored, and construction of a pilot processing plant at Yanbu was planned.

Aluminum.—Southwire Ltd. (United Kingdom) was commissioned in 1978 for a feasibility study of a planned aluminum smelter to be located in Jubail. Design work for the smelter had been postponed in 1976 owing to delays in the gas-gathering program. The $1 billion smelter was expected to reach full production by 1986, and its projected annual production of 225,000 tons of aluminum ingot was destined primarily for export markets.

Aluminum Products Co. (Alupco) brought into production an aluminum-extrusion plant in Damman in 1978. Designed by Alusuisse (Switzerland), the plant was expected to produce 5,000 tons per year of aluminum products, mostly for domestic use. A number of small plants, with a combined capacity of 37,000 tons per year, manufactured aluminum products in Saudi Arabia. In 1978, the Government acquired a 20% interest in the smelter operated by Aluminum Bahrain Ltd. (ALBA) in Bahrain.

Copper.—After 2 years of exploratory work and drilling, evaluations of Saudi Arabia's copper deposits proved disappointing. Noranda Ltd. (Canada) reported that the Kutan deposits, located in the south near the Yemeni border, were too low in copper grade to be of economic value. Also, the Societe d'Etudes de Recherches at d'Explorations Minieres (SEREM) completed its feasibility study of copper deposits at Jabal Sayid, which is located between Mecca and Medina. SEREM determined that exploitation of the deposit, estimated to contain reserves of 8 million tons, was not commercially viable.

In 1979, the Saudi Ministry of Finance granted an interest-free loan of $11 million to the Arabian Shield Development Co. to finance underground exploration and development of the Al Masani area. Drilling has indicated significant amounts of copper, zinc, gold, and silver in two lenses with a combined strike length of 1,600 meters. Watts, Griffis, and McQuat Ltd. was appointed manager of the underground development project, and National Mining Co. was the Saudi partner in the venture. In 1978, Granges AB (Sweden) received a license to explore the Al Nagra copper-zinc deposit located 200 kilometers northeast of Medina. Petromin reserved the right to enter into a joint venture with Granges in the event that commercial exploitation is considered.

Gold.—Petromin acquired a 50% share in the exploration license held by Consolidated Gold Fields for the gold deposits at Mahd adh Dahab. Plans were for Petromin to participate in the third stage of the Mahd adh Dahab exploration program, which was expected to involve drilling and the extraction of bulk samples. Consolidated Gold Fields obtained its license in 1976 for an area of 1,600 square kilometers, northeast of Jidda. Reserves were estimated at 1.5 million ounces of gold and 5 million ounces of silver contained in 6 million tons of comparatively low-grade ore lying close to the surface. No decision on commercial production was expected to be made until 1980.

Iron and Steel.—British Steel Corp. (United Kingdom) continued its study of the Wadi Sawawin iron ore deposits located in northwest Saudi Arabia near the Gulf of Aqaba. The firm was awarded a $15 million contract in 1976 to investigate these deposits, and a final report is due in 1981. Mapping and drilling was being conducted in 1978 to verify the tonnage and grade of the Wadi Sawawin reserves, which were originally estimated at 350 million tons averaging 42% iron.

A final agreement was signed in 1978 with Korf Stahl AG (Federal Republic of Germany) for construction of an iron and steel complex in Jubail. An initial annual production capacity of 850,000 tons of steel billets was anticipated, and the complex was expected to employ the Midrex direct-reduction process, using local natural gas. The facilities were expected to be eventually expanded to 4 million tons per year. Plans were to import iron ore, pending the development of the Wadi Sawawin iron ore deposits. Construction of the $600 million complex was begun in April 1979 and was scheduled to be completed in 1982. The plant was to be owned 80% by the Saudi Arabian Basic Industries Corp. (SABIC) and 20% by Korf Stahl.

Another joint venture was concluded between SABIC (50%) and Korf Stahl (50%) for the modernization and expansion of the Jidda steel-rolling mill. It was planned that the mill's capacity would be increased to 140,000 tons per year of reinforcing bars. The mill was to use imported billets until the Jubail iron and steel complex starts up. The estimated cost of the project was $30 million.

The National Pipe Co., owned 60% by Saudi interests and 40% by Sumitomo Metal Industries (Japan), began construction of a plant at Damman that was scheduled to be completed in July 1980. The plant was expected to produce 80,000 tons per year of spiral-weld pipe.

Saudi Metal Industries began construction of a reinforcement bar plant in Damman in 1979. Production was projected at 20,000 tons per year. The $9 million plant was undertaken as a joint venture by Saudi and British interests (60% and 40%, respectively).

Uranium.—In 1978, the DGMR signed an agreement with Minatome (France) for a 3-year survey for radioactive minerals. The results of a recent aerial survey indicating several radioactive occurrences in Saudi Arabia prompted the DGMR's contract with Minatome for a more extensive study. After general surveying and mapping, Minatome was expected to undertake detailed prospecting in selected areas.

NONMETALS

Cement.—Saudi Arabia's cement consumption increased to 10 million tons in 1978, 80% of which was imported. In 1978, a 1-million-ton-per-year cement plant constructed by Skanska Cement (Sweden) opened in Yanbu, bringing domestic production capacity to 2.5 million tons per year. In 1979, Saudi Cement Co. awarded Polysius AG (Federal Republic of Germany) an $84 million turnkey contract to modernize and expand the Hofuf plant to 1 million tons per year. The third 5-Year Development Plan called for an increase in domestic production capacity to 10 million tons per year. The construction of four new plants was planned as follows:

Location	Operator	Startup date	Capacity (tons per year)
Quassim-Buredah	Quassim Cement Co	1980	730,000
Abqaiq	Saudi-Bahraini Cement Co.	1980	550,000
Neutral Zone	Saudi-Kuwaiti Cement Co.	1981	2,000,000
Rabigh	Jidda Cement Co	1981	1,000,000

Fertilizer Materials.—The Saudi Arabian Fertilizer Co. (SAFCO) initiated its own marketing program in 1978 as production continued to increase. Annual production capacity was rated at 220,000 tons of ammonia, 400,000 tons of urea, 10,000 tons of sulfur, and 20,000 tons of sulfuric acid. SAFCO's plant, located in Damman, was previously operated by Occidental Petroleum Co., and marketing was managed by its subsidiary. In 1978, SAFCO exported approximately 130,000 tons of urea to India and Pakistan. Sim-Chem (Korea) was contracted to construct a new sulfuric acid unit to increase production to 120,000 tons per year.

In 1978, SABIC reached an interim agreement with the Taiwan Fertilizer Corp. (TFC) for construction of a nitrogen fertilizer complex in Jubail that was expected to produce 1,000 tons per day of ammonia and 1,600 tons per day of urea. A feasibility study was completed in 1979, and the Pullman-Kellogg Group (United States) was awarded a $250 million contract to provide preliminary designs, engineering work, startup assistance, staff training, and to purchase equipment and materials. Completion was scheduled for mid-1982. TFC is committed to purchasing 60% of the output.

Feasibility studies on the construction of a triple-superphosphate plant in northwest Saudi Arabia were also planned. The plant was under consideration as a joint venture of Lebanon Chemicals Inc. and the Research and Development Corp. (REDEC), and annual production capacity was projected at 700,000 tons of phosphatic fertilizer.

Phosphate.—The Government embarked on a major study of transportation, water, harbor, and other infrastructure needs in preparation for the possible exploitation of the Thaniyat phosphate deposits. Granges AB continued its drilling and mapping program in a 2,500-square-kilometer area in the northwest corner of the country. Reserves in the Thaniyat district were estimated at 242 million tons of phosphate grading 24% P_2O_5. In the event of exploitation, plans were for a joint venture to be formed between the Government and Granges on a 50-50 basis. In 1979, the Government granted a license to Riofinex for evaluation of the phosphate potential of the Turaif Basin on the northern border of Saudi Arabia.

Magnesite.—SEREM continued its study of magnesite deposits at Zarghat for Saudi Arabia Magnesite Ltd. Reserves at Zarghat, located south of Jabal Said, were estimated at 1 million tons containing more than 95% magnesium carbonate and less than 2% silica. Exploration of the deposits was scheduled to begin in 1979 at the rate of 100,000 tons per year. SEREM was to obtain a 15% share in the operation.

MINERAL FUELS

Natural Gas.—Over half of Saudi Arabia's associated natural gas production was flared, and the remainder was used for oilfield reinjection, fuel for local industries, and NGL production. Saudi oil producers were increasingly utilizing reinjection, owing to the problem of water encroachment, a rising demand for fuel by growing local industries, and greater production of NGL.

Aramco continued construction of the major gas-gathering and treatment system that was contracted for by the Government. In July 1979, the NGL plant at Berri was brought up to full capacity; the entire system was scheduled to be in operation by 1984. The projected processing capacities of the various units were as follows:

Product and location	Design feed[1]	Startup date
Gas:		
Abqaiq	600 MMcfd	1973
Berri	600 MMcfd	1977
Shedgum	1,400 MMcfd	[2]1980
Uthmaniyah	1,400 MMcfd	[2]1981
Natural gas liquid:		
Ras Tanura	360,000 bpd	[2]1973
Ju'aymah	270,000 bpd	[2]1982
Yanbu	270,000 bpd	[2]1984

[1] MMcfd Million cubic feet per day; bpd Barrels per day.
[2] Projected.

Petroleum.—*Production.*—The takeover of Aramco by the Government was completed in 1979, and Aramco became a service company under contract to the Government. A new organization, the Saudi National Oil Co., was created to operate some of the existing petroleum facilities. Petromin was responsible for the marketing and distribution of petroleum products, the development of refining capacity, and Government participation in petroleum-related companies. Plans were for Aramco to continue to market the bulk of crude oil production.

Aramco operated under production ceilings set by the Government. The ceiling was set at 8.5 million barrels per day in 1978 and 9.5 million barrels per day for most of 1979. The light:heavy oil production ratio was scheduled to be increased progressively from 65:35 to 50:50 by the late 1980's. In accordance with decisions reached by OPEC, the price of Arabian light crude oil rose to $24 per barrel by yearend 1979.

Refining.—Domestic consumption of petroleum products increased to 430,000 barrels per day in 1979. Local requirements were expected to reach 700,000 barrels per day by 1984 and exceed 1 million barrels per day by 1988. Saudi Arabia planned a major increase in refining capacity to meet rapidly growing domestic demand as well as the demand from expanding export markets. Plans were for refining capacity to be distributed as follows:

Location	Operator	Startup date	Capacity (barrels per day)
Ras Tanura	Arabian American Oil Co. (Aramco).	1945	600,000
Mina Saud	Getty Oil Co. (GOC)	1958	100,000
Ras al-Khafji	Arabian Oil Co., Ltd. (AOC)	1966	30,000
Jidda	Petromin/Saudi Arabian Refinery Co. (SARCO).	1968	95,000
Riyadh	Petromin	1975	100,000
Yanbu	do	[1]1982	170,000
Do	do	[1]1982	250,000
Jubail	do	[1]1980	250,000
Do	do	[1]1980	125,000

[1] Projected.

A new refinery in Yanbu was built as an alternative to expansion of the Jidda refinery, which recently attained a production capacity of 95,000 barrels per day. United Oil Products (UOP) (United States) received a contract for expansion of the Riyadh refinery to 100,000 barrels per day by 1980. The two refineries served the domestic market exclusively.

Construction of three export-oriented refineries was planned for the new industrial centers of Jubail and Yanbu. Petromin and Shell Oil Co. planned, on a 50-50 basis, to construct a 250,000-barrel-per-day refinery in Jubail. Shell began engineering and design work for the facility in 1978. Petromin also entered into a joint venture with Standard Oil Co. and Texaco Oil Co. for construction of a 125,000-barrel-per-day refinery in Jubail; interest shares were 50%, 25%, and 25%, respectively. Mobil Technical Services Inc. was awarded a $20 million contract for engineering studies for a proposed 250,000-barrel-per-day refinery in Yanbu that would be owned on a 50-50 basis by Petromin and Mobil Oil Co. It was anticipated that the refinery would produce gasoline, distillate fuels, and fuel oil to be marketed in the United States and Europe.

The Jidda Lube Oil Refinery, which is

owned 70% by Petromin and 30% by Mobil, began production in May 1978. Its output of approximately 500,000 barrels of finished base oils was sent to the Petromin Lubricating Oil Co. (Petrolube) plant, also located in Jidda. Full production capacity of the Jidda Lube Oil Refinery was estimated at 1 million barrels per year of lubricating oil base stocks, which were previously imported.

In 1979, Petromin entered into a joint venture with Chevron and Texaco (50%, 25%, and 25%, respectively) to construct a specialized lubricating oil refinery at Jubail. The facility, which would be one of the largest in the world, was expected to produce 12,000 barrels per day of lubricating oil base stocks for domestic use and was scheduled to begin production in 1984.

Petrolube, owned by Petromin (70%) and Mobil (30%), awarded a contract to Chiyodu Construction Co. (Japan) in 1979 for construction of a lubricating oil blending plant at Riyadh. Production capacity was projected at 175,000 barrels per year and production was scheduled to begin in 1981. Plans were for base stock lubricating oils to be supplied by the Jidda Lube Oil Refinery.

A fire damaged the Ras Tanura Refinery in August 1979. About 800,000 barrels of stored products were lost, but the plant was restored to full operating capacity by September 1979.

Petrochemicals.—Methane and ethane production from Saudi Arabia's gas-gathering program was expected to provide basic feedstock for a $7 billion petrochemical industry. SABIC, in a joint venture with a Japanese consortium, concluded an agreement in 1979 to study the feasibility of a $270 million, 600,000-ton-per-year methanol project to begin in 1983 at Jubail. This brought the number of joint ventures with foreign firms for the construction of petrochemical complexes at Jubail and Yanbu to seven. Under the agreement, financing was to be divided among SABIC (60%), the equity partners (30%), and other sources (10%). A feasibility study on boosting the ethylene capacity of the SABIC-Mitsubishi petrochemical complex at Jubail to 450,000 tons per year was completed. Advantages to foreign firms included low-cost feedstocks, low equity requirements, liberal tax incentives, and crude oil entitlements. Most of the projects were still in the planning stage.

Location	Ownership	Major product	Capacity (tons per year)
Jubail	SABIC-Shell Oil Co	Ethylene	656,000
Do	SABIC-Dow Chemical Co	do	400,000
Do	SABIC-Exxon Co	Polyethylene	240,000
Do	SABIC-Mitsubishi Chemical Industries Ltd	Ethylene	450,000
Do	SABIC-Celanese Chemical Co	Methanol	730,000
Do	SABIC-Japanese consortium	do	600,000
Yanbu	SABIC-Mobil Oil Corp	Ethylene	450,000

The petrochemical plant to be constructed by SABIC and Shell Oil Co. was in the most advanced stage. The agreement for this complex was signed in November 1979, and Fluor Corp. was designated as general contractor. C. F. Braun was selected to provide engineering services for the single-stream 656,000-ton-per-year ethylene plant. Other contracts were awarded to Dravo Co. (United States), for a 377,000-ton-per-year caustic soda unit and a 454,000-ton-per-year ehylene dichloride unit; Badger Inc. (United States), for a 295,000-ton-per-year styrene unit; and C. F. Braun (United States), for a 180,000-ton-per-year ethanol unit. Approximately 250,000 tons per year of ethylene production was expected to be supplied to the polyethylene plant that is to be constructed by a SABIC-Exxon joint venture known as Saudex. The remainder of the plant's output was slated for export. The SABIC-Shell complex was scheduled to go onstream in 1982 and was expected to cost $2.1 billion, rather than the $1.8 billion that was originally estimated.

Pipelines.—Construction was proceeding on the two transpeninsular pipelines being built to carry crude oil and NGL from the Eastern Province to Yanbu. Pipe laying began on the crude oil line in December 1978 and on the NGL line in March 1979. Both projects were scheduled for completion in 1981.

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[1] Economist, Branch of Foreign Data.

[2] Physical scientist, Branch of Foreign Data.

[3] Where necessary, values have been converted from Saudi riyals (SRls) to U.S. dollars at the rate of SRls3.4=US$1.00.

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The Mineral Industry of Sierra Leone

By Candice Stevens[1] and Phyllis A. Lyday[2]

The mineral sector of Sierra Leone remained in a depressed state in 1978 following the closure of the Marampa iron ore mine and the decrease in diamond production. Despite lower output, the value of diamond production increased owing to a 30% rise in prices during 1978. Diamond ($102 million),[3] bauxite ($6 million), and refined petroleum products ($60 million) contributed to the 1978 gross national product (GNP). GNP calculated on a fiscal year basis was $817 million during 1977-78 and $901 million during 1978-79. The contribution of the mineral sector was expected to increase with the start of rutile production in 1979 and the potential exploitation of kimberlite diamond pipes. During 1978, mineral exports were approximately 70% of the total exports.

During the 1977-78 fiscal year, Sierra Leone's economy suffered from an inflation rate of 30%, the largest overall budget deficit in the nation's history ($85 million), a total external debt of $205 million, and a continuing balance-of-payments deficit owing to large oil imports. During the 1978-79 fiscal year, the inflation rate of 35% and the overall budget deficit was $84 million, double that of the previous fiscal year. An additional debt burden was Sierra Leone's scheduled role as host to the 1980 Organization of African Unity (OAU) Conference. In 1978, the International Monetary Fund (IMF) granted Sierra Leone a standby loan of $30 million contingent on the implementation of a number of corrective economic measures.

During December of 1978, the Government devalued the unit of currency, the Leone, by 5% and freed it from the sterling zone by linking it to IMF Special Drawing Rights (SRD) as part of an economic reconstruction package. When President Stevens failed to implement the package suggestions, IMF postponed the standby arrangement. In July 1979, new package suggestions were agreed upon and $22 million in IMF loans to support the economic stabilization efforts were approved by IMF. The Government was to restrict foreign borrowing, reduce Government spending, limit credit extension, and institute other budgetary reforms.

A new investment code was proposed to update the Sierra Leone Development Act which governed foreign investment; the code provided for tax holidays ranging from 2 to 5 years, exemption from import duties, and incentives for profit reinvestment. Internal transport facilities were to be upgraded and the ports authority was reorganized.

The first phase of harmonization of tariffs between Liberia and Sierra Leone under the Mano River Union protocols was completed in 1978. The European Economic Community financed a French firm to conduct feasibility studies for the development of a hydroelectric scheme of the Mano River Basin. Sierra Leone Electricity Corp. planned a fifth power station at King Tom to be undertaken by ABU (Federal Republic of Germany). A German engineering firm had completed plans for a proposed highway between the capitals of Freetown in Sierra Leone and Monrovia in Liberia. The Mano River Union also established four joint work force training institutes and was planning a number of industrial projects.

PRODUCTION AND TRADE

Production of Sierra Leone's major mineral commodities, diamond and bauxite, declined in 1978-79; however, the value of mineral production increased owing to the rise in diamond prices. Sierra Leone also produced small amounts of nonmetallic minerals and refined petroleum products. The production of rutile began in 1979. Mineral productin in 1978 is given in table 1.

At the end of fiscal year 1979, Sierra Leone's balance-of-trade deficit increased to approximately $80 million owing largely to the higher price of petroleum imports. Mineral production contributed about 70% of total export value in 1978 with diamond exports contributing 66% of that figure. All bauxite was exported unprocessed to Canada and the Federal Republic of Germany. Approximately 20% of the production of refined petroleum products was exported primarily to Liberia. Sierra Leone imported 7,000 tons of fertilizer in 1978 and 1.7 million barrels of crude oil from Nigeria. The United Kingdom remained Sierra Leone's principal trading partner by supplying the bulk of manufactured imports and taking about 60% of total exports.

Table 1.—Sierra Leone: Production of mineral commodities

Commodity[1] and unit of measure		1976	1977	1978[p]	[illegible]
Aluminum: Bauxite, gross weight	thousand metric tons	651	745	716	[illegible]
Diamond:					
Gem	thousand carats	433	423	283	[illegible]
Industrial	do	650	538	424	[illegible]
Total	do	1,083	961	707	[illegible]
Petroleum refinery products:					
Gasoline	thousand 42-gallon barrels	231	331	394	[illegible]
Jet fuel	do	109	101	102	[illegible]
Kerosine	do	185	199	213	[illegible]
Distillate fuel oil	do	407	464	501	[illegible]
Residual fuel oil	do	423	824	412	[illegible]
Liquefied petroleum gas	do	3	10	10	[illegible]
Refinery fuel and losses	do	29	6	43	[illegible]
Total	do	1,387	1,935	1,675	[illegible]
Salt	thousand metric tons	180	180	180	[illegible]
Titanium: Rutile ore and concentrate, gross weight	do	--	--	--	[illegible]

[e] Estimate. [p] Preliminary.

[1] In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) is produced, but output is not reported and available general information is inadequate to make reliable estimates of output levels. Gold may occur, but data are not available for estimating production. Sierra Leone annually refines 4,000 to 10,000 metric tons of salt from imported crude marine salt, but this is not included in the body of the table because it would represent double counting of materials credited to the country where the salt was originally collected.

[3] Reported figure.

COMMODITY REVIEW

During 1979, a comprehensive article entitled "The Geology and Mineral Resources of Sierra Leone"[4] was published which included locations and descriptions of metallic and nonmetallic minerals. A history of the exploration and exploitations of these resources and a geologic map was also included.

METALS

Bauxite.—The Sierra Leone Ore and Metal Co. (SIEROMCO), wholly owned by Swiss Aluminum Ltd. (Alusuisse) (Switzerland), had mined bauxite in the Mokanji Hills near Moyamba in southwestern Sierra Leone since 1963. Remaining reserves were estimated at approximately 25 million tons of ore.[5] In 1978, SIEROMCO renegotiated with the Government its contract to exclude Government participation in the mining venture and to increase the tax and royalty rates to be paid by SIEROMCO. A new jetty was under construction at the port of Niti from which bauxite was shipped after being transported 21 kilometers from the Mokanji Mine.

Alusuisse continued its negotiations with the Government concerning the conditions for a new bauxite mine at Port Loko. In 1978, reserves at Port Loko were estimated at 70 million tons of ore containing 47% Al_2O_3; an additonal 34 million tons was highly probable.[6] The Government was to have a 50% share in the mining venture and would receive taxes and royalties from Alusuisse after an initial 5-year tax holiday. Alusuisse was to have use of the abandoned Sierra Leone Development Co. Ltd. (DELCO) railroad from Marampa to the Port of Pepel. Production of 1 million tons of bauxite per year was to begin in the mid-1980's. An alumina plant, financed by an international consortium led by Alusuisse, was to be constructed in Pepel.

Gold.—Eurocan Ventures Ltd. (EVL) (Canada) entered into a joint venture gold agreement with Diamond Distributors Explorations Inc. (DDX) (United States). After an initial investment of $2 million for a 60% interest of a 10-square-mile diamond-gold concession, the cost of development will be prorated. DDX will maintain the diamond rights.

Iron Ore.—The Government contracted LKAB International AB (Sweden) to conduct a feasibility study for reopening the Marampa iron ore mine located in the Port Loko district. The study was to include assessment of ore reserves, evaluation of existing facilities, and prediction of potential for producing salable products. The Marampa iron ore deposits were mined by DELCO from 1933 until 1975 when the company encountered financial difficulties. Reserves were last estimated at 67 million tons of 37% iron ore. Since 1975, installations at Marampa and the Port of Pepel have been kept on a care and maintenance basis by a skeleton staff. Reserves at a second location, Tokolili, about 80 kilometers northeast of Marampa, were estimated at 124 million tons of 55% iron ore. Negotiations between the Government and Bethlehem Steel Corp. (United States) for reopening the Marampa Mine in conjunction with exploitation of the Tokolili deposit were unsuccessful.

Titanium Minerals.—Production of rutile at Gbangbama in Moyamba and Bonthe district by Sierra Rutile Ltd. (SRL) began in mid-1979. Initial production was to be at the rate of 35,000 tons per year building up to 100,000 tons per year to make Sierra Leone the world's second largest producer of rutile after Australia. Reserves were estimated at 110 million tons of black sand with a rutile content of 1.8%.[7] SRL, a joint venture of Bethlehem Steel Corp. (85%) and NORD Resources Corp. (15%), was to pay the Government a royalty of $4 per ton of production and approximately 50% of profits. Nearly $50 million was invested by SRL in machinery, equipment, and buildings. The entire output was to be exported for use in paint manufacture, glass and porcelain manufacture, and as an alloying material.

SRL acquired the Gbangbama leases from Sherbro Minerals Ltd. which liquidated in 1971 owing to problems with the dredging equipment. SRL planned to mine the rutile using a 24-cubic-yard bucket dredge designed by F.W. Payne and Son (Bickley) Ltd. and constructed by Taylor Woodrow Contract Services (United Kingdom). The dredge was to operate in a pond impounded by six dams constructed by Allgemeine Bou-Union GmbH (West Germany). A treatment plant constructed by Taylor Woodrow was to use electrostatic and magnetic separators and produce titanium concentrates containing 95% TiO_2, 1% ZrO_2, and 1% $Fe2O_3$. Taylor Woodrow was also responsible for the electrical transmission system and the expansion of the powerplant. A joint subsidiary of West German firms, Bayer A.G. and Preussag Metal, was reported to have relinquished their rutile concession in the Bradford and Rotifunk (Mogbwemo) areas of Southern Province.

NONMETALS

Clays.—The Sierra Leone clay factory with a capacity of 70,000 brick per week began production in December 1979. Four types of high-quality clay from different parts of the country are used by the factory.

Diamond.—Diamond production has been gradually declining over the past years from 2 million carats per year in the early 1970's. Approximately 40% to 55% of diamond output was gemstone. The National Diamond Mining Co. (DIMINCO) has experienced a steady decrease in output owing to the lower grade of deposits available for mining and depredation by illicit miners. DIMINCO, which held exclusive mining rights to the large Yengema Area and the smaller Tongo Area, reduced its staff and closed two processing plants in an effort to prolong its alluvial operations. Higher diamond prices in 1978 allowed the company's operations to remain viable; DIMINCO accounted for less than half of the country's diamond production in that year.

Aluvial mining by DIMINCO was expected to cease when underground mining of Kimberlite pipes in the Kono district commenced in approximately 5 years. Financing terms were under negotiation by the two major shareholders in DIMINCO, the Government (51%) and Sierra Leone Selection Trust Ltd. (49%). Plans called for diagonal shafts to be sunk on either side of the kimberlite and the reopening of treatment plant No. 6. An investment of $40 million was expected to yield a production rate of 300,000 carats per year.

The balance of diamond production was by hundreds of individual miners licensed to dig on specific plots in accordance with the Alluvial Diamond Mining Scheme (ADS), introduced in 1956 to discourage illicit digging. Licenses were issued to nationals of Sierra Leone or to firms with a Sierra Leonean majority holding for digging in 23,000 square kilometers of area outside the DIMINCO concessions. Diamonds offered for sale under the ADS increased in 1978 owing to a decrease in export duty to 2.5% for all sizes and categories dating from February 1, 1978. Prior to that date, the export duty was 7.5% on all sizes up to 14.8 carats and 2.5% for all those larger than 14.8 carats. Approximately 35% of Sierra Leone's diamond production was sold to Diamond Corp. of West Africa Ltd. (DICORWAF), a subsidiary of DeBeers Consolidated Mines Ltd. The remainder was sold to licensed buyers including Leon Templeman and Sons, Universal Mines Ltd., and Gems of Sierra Leone, all of the United States.

MINERAL FUELS

Petroleum.—Production of refined petroleum products by the Sierra Leone Petroleum Refining Co. was approximately 1.6 million barrels during 1978. The refinery, located in Freetown, was jointly owned by the Government and five oil companies: British Petroleum Co., Texaco Ltd., Shell Oil Co., Mobil Oil Corp., and Azienda Generale Italiana Petroli S.p.A. (Agip). All crude oil was imported. In 1978, the Government signed an exclusive agreement for offshore oil and gas exploration with Aracca Petroleum Co., in combination with Sundance Petroleum Co. and Oxocco Petroleum Co., for a period of 1 year.

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[1] Economist, Branch of Foreign Data.

[2] Physical scientist, Branch of Foreign Data.

[3] Where necessary, values have been converted from Leones (Le) to U.S. dollars at the rate of Le1 = US$0.96.

[4] Morel, S.W. The Geology and Mineral Resources of Sierra Leone. Econ. Geo. V. 74, No. 7, 1979, pp. 1563-1576.

[5] U.S. Embassy, Freetown, Sierra Leone. Department of State Airgram, A-10, Apr. 23, 1979, p. 3.

[6] U.S. Embassy, Freetown, Sierra Leone. State Department Airgam A-10, Apr. 23, 1979, 5 pp.

[7] Mining Magazine. Sierra Leone Start Up. V. 141, No. 1, July 1979, p. 55.

The Mineral Industry of the Republic of South Africa

By Miller W. Ellis[1] and Charles W. Sweetwood[2]

The mineral industry continued to dominate the economy of the Republic of South Africa in 1978 and 1979 when mineral products accounted for more than one-half of the country's export value and for about one-fifth and one-fourth, respectively, of the gross domestic product (GDP). The value of mineral production increased to records of $7.9 billion[3] in a GDP of $46 billion in 1978 and $11.4 billion in a GDP of more than $57 billion in 1979. Although production of gold and diamond was virtually unchanged, the sales value of gold and diamond increased markedly both in 1978 and 1979. Together with coal, these commodities accounted for more than $6 billion in 1978 and nearly $9 billion in 1979 in mineral sales. New coal loading facilities at Richard's Bay handled nearly 2.7 million tons in 1978 and allowed total coal exports to increase from 15.4 million to 23.3 million tons from 1978 to 1979. The Saldanha Bay export facilities handled less iron ore than in 1977, but construction of a new 250-meter ore outloading pier was nearly completed. The new pier had an initial loading capacity of 6,000 tons per day and was designed to handle copper and lead concentrates from the new Phelps Dodge/Gold Fields of South Africa Ltd. (GFSA) underground mine at Aggeneys, northwest Cape Province.

Through its Industrial Development Corporation of South Africa Ltd. (IDC), the government indirectly controlled such companies as the Phosphate Development Corporation Ltd., which mined and processed apatite rock into phosphate concentrate near Phalaborwa in the Transvaal Province, and the state's Alluvial Diamond Diggings of Alexander Bay at the mouth of the Orange River. The state also maintained a controlling interest in the South African Iron and Steel Corp. Ltd. (ISCOR), which operated one colliery, two iron mines, one tin mine, one zinc mine, and two dolomite quarries, in addition to its three major steelworks at Vanderbijlpark, Pretoria, and Newcastle. Until October 1979 the state owned and operated the country's coal-to-oil synthetic crude oil ("syncrude") refineries. The syncrude facilities— operating as the South African Coal, Oil and Gas Corp. Ltd. (SASOL)— included the company's original pilot plant SASOL I and its captive Sigma colliery at Sasolburg in the Orange Free State, and the second generation SASOL II and III plants under construction near the developed Bosjesspruit coal mine at Secunda in the Transvaal.

In October 1979 the corporation became a new multisector company, SASOL Ltd., with IDC and a Konoil company holding 30% and the other 70% held by institutional, corporate, and small investors. For SASOL II the $3.0 billion total capital was from Parliamentary appropriations and the state Oil Fund, plus $585.5 million from export credits and loans. SASOL III's anticipated cost of $3.9 billion should include nearly $800 million from loans and export credit. SASOL II's coal gasification units were scheduled to start up in April 1980 and the liquification units by October 1980 at an estimated annual rate of 18.7 million barrels of syncrude from 12 million tons of coal. With the improvements already projected the capacity might reach 30 million barrels per year of syncrude. SASOL III was scheduled for commissioning as a "carbon copy" in 1982, and the Bosjesspruit colliery was being geared for a production rate of 27 million tons per year of coal by 1982.

PRODUCTION AND TRADE

The Republic of South Africa continued as the world's leading producer of chromite, gem diamonds, gold, platinum, and vanadium, and as one of the three top producers of antimony, asbestos, industrial diamond, manganese, uranium, and vermiculite. Details of mineral production are shown in table 1.

Mineral products from the Republic of South Africa continued to be a major source of raw material for the manufacturing industries of Western Europe, the United States, and Japan. Both demand and price for many industrial commodities weakened during 1978, but strengthened in 1979, in some cases to record figures. The main exception was coal, the exports of which increased both in volume and in value during both years through the new Richard's Bay coal-loading facilities. Although gold sales declined in 1979, the price of gold continued to rise throughout both years to a recordbreaking average of $307 per troy ounce for 1979. The price of gem diamonds was increased 30% by De Beers Central Selling Organization in 1978 and 17% in 1979 to gross values of $513 million and $651 million, respectively. The quantity of iron and manganese ores exported declined, but their value decreased to $190 million and $100 million, respectively, in 1978. The 1979 exports set new records for both quantity and value. Major mineral imports continued to include crude oil and alumina. Details of exports from and imports to the Republic of South Africa are shown in tables 2 and 3. Table 4 lists comparisons of the value of commodities exported and sold domestically during 1977, 1978, and 1979.

Table 1.—Republic of South Africa: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum metal	78,400	78,000	81,100	[1]82,000
Antimony concentrate:				
Gross weight	[r]18,341	20,053	16,395	19,900
Metal content	10,698	11,535	9,094	11,755
Beryl concentrate (11%-12% BeO)	3	3	4	--
Chromite, gross weight:				
More than 48% Cr_2O_3 thousand tons	[r]25	53	33	[1]33
44%-48% Cr_2O_3 do	1,312	1,607	1,524	[1]1,633
Less than 44% Cr_2O_3 do	1,072	1,399	1,588	[1]1,631
Total do	2,409	3,059	3,145	[1]3,297
Columbium-tantalum concentrate kilograms	--	--	143	550
Copper:				
Mine output, metal content	196,880	208,287	205,745	[1]190,001
Metal:				
Smelter	[r]168,000	188,400	191,400	178,000
Refined	[r]95,600	145,900	149,100	[1]150,737
Gold, primary thousand troy ounces	22,936	22,502	22,649	[1]22,617
Iron and steel:				
Iron ore and concentrate thousand tons	15,663	26,481	24,206	[1]31,565
Metal:				
Pig iron do	5,795	6,114	5,910	[1]7,081
Ferroalloys, blast-furnace and electric-furnace:				
Ferrochromium[e] do	350	380	480	600
Ferromanganese[e] do	350	400	460	530
Ferrosilicon[e] do	79	100	120	128
Ferrosilicomanganese[e] do	22	25	30	[illegible]
Ferrosilicochrome[e] do	22	29	30	[illegible]
Ferrovanadium[e] do	([2])	([2])	([2])	([2])
Total do	823	934	1,120	[illegible]
Crude steel:				
Ingots do	6,926	7,178	7,635	8,550
Castings do	230	201	165	265
Total do	7,156	7,379	7,800	[1]8,816

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
For immediate sale thousand tons	250	538	[e]540	550
Hot-rolled products do.	4,700	4,844	[e]5,000	5,000
Iron castings do.	478	365	374	400
Steel castings and forgings do.	142	133	[e]36	50
Total do.	[r]5,565	5,880	[e]5,950	6,000
Lead metal, smelter	22,000	24,000	23,600	22,900
Manganese ore and concentrate, gross weight:				
Metallurgical:				
Over 48% Mn thousand tons	270	263	262	296
45%-48% Mn do.	1,517	1,198	1,131	998
40%-45% Mn do.	209	577	430	763
30%-40% Mn do.	3,358	2,839	2,357	2,897
Total do.	5,354	4,877	4,180	4,954
Chemical:				
Over 65% MnO_2 do.	3	(3)	--	(3)
35%-65% MnO_2 do.	95	171	118	153
Less than 35% MnO_2 do.	--	--	19	76
Total do.	98	171	137	229
Grand total do.	[r]5,452	5,048	4,317	[1]5,183
Manganiferous iron ore (15%-30% Mn, 20%-35% Fe)	50,964	242,155	95,699	100,000
Nickel:				
Mine output, metal content	22,371	21,955	22,000	22,000
Metal, electrolytic	17,000	17,200	17,500	17,500
Platinum-group metals, metal content of concentrate, matte, and refinery products[e] [3] thousand troy ounces	2,700	[r]2,870	2,860	3,200
Silver metal, primary do.	2,821	3,130	3,104	3,236
Tin:				
Concentrate:				
Gross weight	[r]5,625	6,139	6,120	6,200
Metal content	2,799	2,864	2,886	2,697
Metal, primary	683	582	[4]637	700
Titanium:				
Sand	--	--	18,100	41,740
Slag	--	--	90,700	300,000
Uranium oxide (U_3O_8)	3,254	3,962	4,672	5,500
Vanadium:				
Vanadiferous slag, gross weight	[r] [e]50,000	53,969	54,381	55,000
V content:				
Of vanadiferous slag[e]	[r]7,000	[r]7,556	7,600	8,400
Of V_2O_5 and vanadate products[e]	[r]2,875	[r]3,682	3,650	3,900
Total	9,875	11,238	[e]11,250	12,300
Zinc:				
Concentrate:				
Gross weight	149,922	139,262	130,318	100,000
Metal content	74,961	69,681	65,159	50,000
Metal, smelter	66,200	76,000	79,100	80,000
Zirconium concentrate (baddeleyite)	11,252	16,825	[e]36,000	82,000
NONMETALS				
Asbestos:				
Amosite	78,898	66,963	40,526	[1]39,058
Anthophyllite	1,506	550	--	--
Chrysotile	111,025	111,575	79,511	[1]91,828
Crocidolite	178,411	201,056	137,288	[1]118,301
Total	369,840	380,164	257,325	[1]249,187
Barite	1,915	2,500	2,355	[1]2,494
Cement, hydraulic thousand tons	[r]7,049	6,573	6,824	[1]6,900
Clays:				
Attapulgite	--	--	2,773	3,000
Bentonite	39,602	37,221	34,519	[1]46,394
Fire clay	207,195	167,835	223,413	[1]310,670
Flint clay	190,731	193,229	167,285	[1]180,070

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity		1976	1977	1978[p]	1979[e]
NONMETALS —Continued					
Clays —Continued					
Fuller's earth		--	--	258	[1]313
Kaolin		59,733	88,619	122,024	[1]148,740
Montmorillonite		--	--	1,299	[1]1,287
Corundum, natural		142	138	18	65
Diamond:					
Gem	thousand carats	3,340	3,628	3,678	3,670
Industrial	do	3,683	4,015	4,049	3,970
Total	do	7,023	7,643	7,727	7,640
Diatomite		619	666	930	907
Feldspar		46,138	51,230	52,545	52,300
Fluorspar:					
Acid grade		210,874	234,649	297,591	[1]387,365
Ceramic grade		39,502	65,660	14,907	[1]8,477
Metallurgical grade		40,342	50,370	80,778	[1]55,270
Total		290,718	350,679	393,276	[1]451,112
Gem stones, semiprecious:					
Emerald crystals	kilograms	1,494	2,076	1,047	2,000
Tiger's eye	do	206,210	339,557	346,102	300,000
Graphite		530	911	583	625
Gypsum, crude		482,375	439,688	388,734	[1]377,467
Kyanite-related materials:					
Andalusite		77,464	113,076	112,040	[1]134,177
Sillimanite		25,733	15,455	9,540	[1]19,574
Lime[3]	thousand tons	1,387	1,504	1,875	2,540
Magnesite, crude		62,858	49,219	37,407	40,000
Mica:					
Sheet	kilograms	220	45	74	40
Waste		2,380	3,142	2,542	1,150
Nitrogen, N content of ammonia	thousand tons	470	508	563	565
Phosphate rock, gross weight	do	[r]1,731	2,403	2,699	3,100
Pigments, mineral, natural:					
Ochers		1,288	1,561	1,244	1,300
Oxides		755	609	943	700
Umber		368	--	--	--
Total		2,411	2,170	2,187	2,000
Pyrite, gross weight		735,110	829,509	765,130	700,000
Quartz, quartzite, glass sand (silica)	thousand tons	1,225	1,017	1,013	1,000
Salt		223,662	242,254	489,925	[1]533,735
Silcrete		5,979	4,340	5,434	5,000
Stone, n.e.s.:					
Dimension:					
Granite:[5]					
Sawn slabs		32,316	24,084	9,341	20,000
Rough blocks		263,367	388,719	203,983	168,000
Marble		16,220	8,523	2,369	2,000
Crushed and broken:					
Limestone	thousand tons	13,739	13,076	14,112	14,000
Shale	do	369	267	376	400
Sulfur:					
S content of pyrite	do	294	332	340	340
Byproduct:					
Of metallurgy	do	91	105	100	100
Of petroleum	do	27	28	25	25
Total	do	412	465	465	465
Talc and related materials:					
Talc		7,039	8,095	7,487	8,000
Pyrophyllite (wonderstone)		5,784	5,109	5,159	5,000
Vermiculite		222,077	165,419	209,093	[1]191,571
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e]		43,100	45,000	40,000	40,000
Coal:					
Anthracite	thousand tons	[r]2,459	2,559	2,150	[1]3,300
Bituminous coal	do	74,600	82,852	88,208	[1]100,450
Total	do	[r]77,059	85,411	90,358	[1]103,750

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coke:				
Coke oven and beehive thousand tons	4,608	5,201	4,869	[1]4,951
Gashouse, low and medium temperature[e] do	110	110	110	110
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	29,783	30,083	30,090	NA
Jet fuel do	2,196	2,349	2,440	NA
Kerosine do	3,132	3,338	3,333	NA
Distillate fuel oil do	31,279	31,918	32,973	NA
Residual fuel oil do	22,027	22,036	22,178	NA
Lubricants do	2,228	2,262	2,240	NA
Other do	8,581	8,607	7,372	NA
Refinery fuel and losses do	5,561	5,624	5,700	NA
Total do	104,787	106,217	106,326	112,000

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] Reported figure.

[2] Less than 1/2 unit.

[3] Includes osmiridium from gold ores, estimated at 2,500 troy ounces per year.

[4] Sales.

[5] Domestic sales plus exports. Production not reported.

Table 2.—Republic of South Africa: Exports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978
METALS			
Aluminum metal, unwrought[2]	20,400	28,300	37,400
Antimony ore and concentrate, gross weight	5,958	8,452	3,173
Chromium:			
Chromite ore and concentrate, gross weight:			
More than 48% Cr_2O_3[3]	50	3,256	--
44%-48% Cr_2O_3[3]	231,103	460,170	658,135
Less than 44% Cr_2O_3[3]	366,372	621,880	471,509
Total	597,525	1,085,306	1,129,644
Chromite sand, gross weight:			
More than 48% Cr_2O_3[3]	--	78	--
44%-48% Cr_2O_3[3]	393,698	241,527	252,811
Less than 44% Cr_2O_3[3]	203,060	136,493	40,133
Total	[3]596,758	378,098	292,944
Copper:[3]			
Ore and concentrate, metal content[4]	23,600	25,500	18,100
Metal:			
Blister and anode	69,400	67,400	36,900
Refined	45,600	96,200	92,800
Iron and steel:			
Iron ore, gross weight:			
Hematite[e] [3] thousand tons	3,663	11,000	10,976
Magnetite[e] [3] do	550	440	66
Total do	4,213	11,440	11,042
Metal:			
Scrap[5] do	3	3	7
Pig iron[5] do	1	3	33
Sponge iron and powder[5] do	31	NA	(6)
Ferroalloys:			
Ferrochromium[5]	340,600	[e]330,300	674,800
Ferromanganese[5]	330,300	[e]310,200	372,000
Ferrosilicon[5]	59,600	[e]56,300	61,400
Other[5]	41,700	[e]38,400	47,700
Total	772,200	[e]735,200	1,155,900

See footnotes at end of table.

Table 2.—Republic of South Africa: Exports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Ingots and other primary forms[3]	182,800	500,400	124,400
Semimanufactures:[3]			
Bars and rods	131,600	176,500	450,500
Angles, shapes, sections	106,600	358,900	556,000
Plates and sheets	459,900	795,000	474,700
Hoop, strip, coil	9,800	27,400	504,500
Rails and accessories	14,000	26,100	22,000
Wire	10,300	10,300	11,600
Tubes, pipes, fittings (including cast pipe)	16,700	22,700	60,500
Castings and forgings	3,900	2,100	6,000
Total	752,800	1,414,000	2,107,200
Lead metal, unwrought[2] [3]	16,700	24,000	38,000
Manganese ore, gross weight:[6] [3]			
Metallurgical	3,446,435	3,047,317	2,896,945
Chemical	215	8,247	4,986
Manganiferous	295,350	273,381	51,984
Total	3,742,000	3,328,945	2,952,915
Nickel metal, unwrought[6] [3]	19,200	19,694	20,000
Tin concentrate	1,768	2,386	2,212
Vanadium materials, V_2O_5 equivalent	r12,885	13,635	15,000
Zinc:			
Concentrate, gross weight	86,048	59,569	41,800
Metal, unwrought[3]	7,000	16,600	1,700
NONMETALS			
Asbestos:			
Amosite	r66,978	67,027	64,184
Anthophyllite-tremolite	818	159	--
Chrysotile	81,056	93,631	71,225
Cape blue	170,412	172,750	131,541
Transvaal blue	--	90	117
Total	319,264	333,657	267,337
Clays and clay products:			
Bentonite:			
Crude	1,786	1,216	722
Processed	20	--	132
Fire clay, calcined	--	1,606	--
Flint clay:			
Raw	8,911	40	40
Calcined	77,977	72,505	77,661
Kaolin:			
Crude	--	--	900
Milled	--	152	--
Washed	117	895	--
Feldspar	3,247	2,548	2,712
Fertilizer materials: Phosphate rock, concentrated	11,118	4,510	--
Fluorspar:			
Acid grade	178,479	246,586	309,168
Ceramic grade	r28,845	9,167	10,640
Metallurgical grade	8,591	32,878	64,579
Total	215,915	288,626	384,387
Gem stones: Emerald crystals kilograms	900	1,987	1,300
Graphite, processed	--	374	311
Gypsum	11,400	14,229	3,654
Kyanite-related materials:			
Andalusite	16,357	71,739	54,457
Sillimanite	12,960	14,235	14,196
Lime, slaked and other	39,612	35,382	29,738
Mica:			
Waste	244	1,254	571
Ground	932	1,646	1,094
Pigments, mineral:			
Ochers	607	806	186
Oxides	10	10	--
Salt	19,596	10,672	28,300

See footnotes at end of table.

Table 2.—Republic of South Africa: Exports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978
NONMETALS —Continued			
Stone, sand and gravel:			
Dimension stone:			
Granite:			
Sawn slabs	14,066	7,489	3,571
Raw blocks	207,409	279,134	194,942
Marble cubic meters	3,141	2,907	1,728
Quartzite:			
Tiles	780	1,265	1,084
Other	--	--	287
Limestone	6,854	4,707	10,050
Slate:			
Dust	478	--	--
Tiles	2,490	1,535	6,451
Other	1,612	256	254
Silica:			
Crude	5	--	59
Processed	381	1,105	626
Sulfur, S content of pyrite	--	--	17,236
Talc and related materials:			
Talc and steatite	--	614	--
Pyrophyllite (wonderstone)	3,834	753	6,837
Vermiculite	187,416	148,610	186,665
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite thousand tons	[r]1,530	2,224	2,528
Bituminous coal do	[r]4,431	10,478	12,861

[e]Estimate. [r]Revised. NA Not available.

[1] Because official South African trade statistics provide data only on the value of total exports of each commodity class (with no data on destinations), this table has been compiled from several sources and includes some estimates. Unless otherwise specified, data are from the quarterly publication "Minerals" issued by the Department of Mines of the Republic of South Africa (various issues 1974-78).

[2] World Bureau of Metal Statistics. World Metal Statistics, October 1979, London. 1979, 112 pp.

[3] American Consulate General, Johannesburg. Various airgrams.

[4] Exports from the Territory of South-West Africa are included in source publication, and no basis is available for distribution of this total between the Republic of South Africa and the Territory of South-West Africa.

[5] 1977 data for ferroalloys are Bureau of Mines estimates. All other data are from: United Kingdom Iron and Steel Statistics Bureau. International Steel Statistics—Republic of South Africa. 1976, 1977, and 1978.

[6] Less than 1/2 unit.

Table 3.—Republic of South Africa: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite	24,033	18,119	Australia 10,506; Denmark 5,687.
Oxide and hydroxide	159,737	184,956	Australia 176,556.
Metal including alloys:			
Scrap	661	518	United States 205; Federal Republic of Germany 66.
Semimanufactures	6,937	7,355	United States 2,785; Federal Republic of Germany 1,290; Japan 1,266.
Arsenic:			
Oxides and acids	165	--	
Metal	13	17	United States 7; Sweden 5; U.S.S.R. 5.
Chromium:			
Chromite	66,586	1,348	NA.
Oxide and hydroxide	320	319	Federal Republic of Germany 215; United Kingdom 50; Poland 48.
Cobalt oxide and hydroxide	2	8	Federal Republic of Germany 2; United States 2.
Copper:			
Ore and concentrate	199	(1)	NA.
Metal including alloys:			
Scrap	197	210	NA.
Unwrought	3,535	967	NA.
Semimanufactures	2,330	1,908	Federal Republic of Germany 579; United Kingdom 542; Japan 297.

See footnotes at end of table.

Table 3.—Republic of South Africa: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Gold metal, unworked or partly worked troy ounces	2,382	2,757	Federal Republic of Germany 621; United Kingdom 344; France 260.
Iron and steel:			
Ore and concentrate value	$219	$519	NA.
Metal:			
Scrap	30,486	16,769	NA.
Pig iron, ferroalloys, similar materials	10,527	7,774	Sweden 1,949; Brazil 454; United Kingdom 384.
Steel ingots and other primary forms	2,117	10,085	United Kingdom 2,555; Japan 2,020.
Semimanufactures:			
Bars and rods	7,517	9,019	United Kingdom 3,449; Federal Republic of Germany 1,789; Japan 850.
Angles, shapes, sections	2,611	7,978	United Kingdom 3,202; Belgium-Luxembourg 3,087.
Plates and sheets	31,913	50,759	Japan 27,306; Federal Republic of Germany 14,716.
Hoop and strip	8,673	10,371	Japan 3,298; United Kingdom 1,972; Federal Republic of Germany 1,589.
Rails and accessories	637	1,067	NA.
Wire and wire rod	13,133	20,120	Belgium-Luxembourg 1,313; France 971; Italy 926.
Tubes, pipes, fittings	48,087	32,703	Japan 16,882; Federal Republic of Germany 4,318; United States 2,476.
Castings and forgings, rough	2,289	540	United Kingdom 329.
Total	114,860	132,557	
Lead:			
Oxides	13	19	Federal Republic of Germany 7; United Kingdom 4.
Metal including alloys:			
Unwrought	2,202	5,662	NA.
Semimanufactures	9	30	United Kingdom 19.
Magnesium metal including alloys, all forms	413	566	Canada 430.
Manganese:			
Ore and concentrate	4,906	3,339	United Kingdom 1,919; Belgium-Luxembourg 394.
Oxides	3,769	3,739	Belgium-Luxembourg 3,212.
Mercury 76-pound flasks	1,958	2,086	Mexico 1,221; Spain 476.
Molybdenum metal including alloys, all forms	19	17	Brazil 11.
Nickel metal including alloys, all forms	3,546	4,204	Canada 763; United Kingdom 341.
Platinum-group metals including alloys, all forms troy ounces	10,592	21,552	United Kingdom 10,440; Federal Republic of Germany 7,354.
Silicon and tellurium	4	78	Spain 58; United Kingdom 16.
Silver:			
Waste and sweepings troy ounces	13,309	13,445	NA.
Metal including alloys, all forms do.	406,841	968,367	Federal Republic of Germany 736,841; United Kingdom 166,415.
Tin:			
Oxides	21	--	
Metal including alloys:			
Scrap	([1])	280	NA.
Unwrought and semimanufactures	859	462	United Kingdom 5; Australia 3; Italy 2.
Titanium (ilmenite):			
Ore and concentrate	1,067	24	NA.
Oxides	171	504	United States 317; Federal Republic of Germany 144.
Tungsten:			
Ore and concentrate	483	508	Brazil 150; Australia 90.
Metal including alloys, all forms	32	142	United Kingdom 30; Austria 20; Sweden 16.
Zinc:			
Ore and concentrate	1	4,196	All from Australia.
Oxides	314	493	Federal Republic of Germany 231; United Kingdom 191.
Metal including alloys:			
Scrap, including powdered dust	61	167	NA.
Unwrought	466	11	Norway 9.
Semimanufactures	33	21	Federal Republic of Germany 4; Japan 4.
Zirconium ore and concentrate	129	91	All from Australia.
Other:			
Ores and concentrates:			
Of molybdenum, tantalum, vanadium	29	446	Federal Republic of Germany 186; United States 159.

See footnotes at end of table.

Table 3.—Republic of South Africa: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Other —Continued			
Ores and concentrates —Continued			
Of base metals, n.e.s	1,714	467	Australia 454.
Ash and residue containing nonferrous metals	12,519	12,315	Federal Republic of Germany 2,271; United Kingdom 1,187.
Oxides, hydroxides, peroxides of metals	250	372	United States 215; Federal Republic of Germany 75.
Elemental boron, phosphorus, and/or selenium	88	80	United Kingdom 53; Federal Republic of Germany 22.
Metals including alloys, all forms:			
Alkali, alkaline-earth, rare-earth metals	653	83	Canada 35; United Kingdom 22.
Pyrophoric alloys	5	--	
Base metals including alloys, all forms, n.e.s.	187	310	United Kingdom 117; United States 78.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	6,534	559	United States 136; Netherlands 52.
Grinding and polishing wheels and stones	392	350	United Kingdom 91; Federal Republic of Germany 79.
Asbestos	24,519	15,151	NA.
Barite	3,442	2,436	Israel 837; United Kingdom 659.
Boron materials: Crude natural borates	1,195	1,222	United States 545; United Kingdom 383; Netherlands 258.
Bromine	4	51	Israel 29.
Cement	79,733	59,549	United Kingdom 2,051; Spain 1,401; United States 1,179.
Chalk	23,586	4,781	France 3,317; United Kingdom 963.
Clays and clay products:			
Crude clays and refractory minerals	24,960	24,386	United States 13,284; United Kingdom 9,648.
Products:			
Refractory	15,304	16,503	Federal Republic of Germany 6,515; Austria 2,267; United States 1,640.
Nonrefractory	570	284	NA.
Cryolite and chiolite	108	152	Denmark 131.
Diamond:			
Gem carats	140,000	73,500	Belgium-Luxembourg 20,500; United Kingdom 17,000.
Industrial thousand carats	2,849	763	United Kingdom 239; Ireland 86.
Diatomite and other infusorial earth	4,735	7,728	United States 4,332; Spain 3,000.
Feldspar, leucite, nepheline syenite	26	40	NA.
Fertilizer materials:			
Crude:			
Phosphatic	--	4	NA.
Potassic	222,043	153,627	Federal Republic of Germany 66,875; Israel 35,251; Canada 19,662.
Other	4	13	Norway 10.
Manufactured:			
Nitrogenous	6,673	597,946	Federal Republic of Germany 116,239; Netherlands 21,362.
Phosphatic	61	34,678	United States 33,533.
Potassic	3,958	111,244	Israel 51,672; Canada 24,680; Federal Republic of Germany 23,909.
Other, including mixed	11,000	631	Belgium-Luxembourg 414; Netherlands 152.
Graphite, natural	461	520	Norway 340.
Gypsum and plasters	5,605	5,216	Federal Republic of Germany 3,524; Spain 1,010.
Lime	2,702	4,420	France 4,261.
Lithium minerals, not further described	11,722	9,262	NA.
Magnesite	85,841	83,792	Italy 15,797; Japan 12,134; United Kingdom 3,982.
Mica:			
Crude, including splittings and waste	559	567	United Kingdom 8.
Worked, including agglomerated splittings	43	44	Belgium-Luxembourg 15; Switzerland 9; United States 8.
Pigments, mineral:			
Natural, crude	327	--	
Iron oxides, processed	3,872	3,875	Federal Republic of Germany 2,716; United Kingdom 404.
Precious and semiprecious stones, except diamond value, thousands	$4,386	$4,102	Ireland $505; United Kingdom $237; Switzerland $232.
Pyrite	30	53	United States 28.
Salt	35,640	5,142	Australia 3,197; United Kingdom 596.

See footnotes at end of table.

Table 3.—Republic of South Africa: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Sodium and potassium compounds, n.e.s.:			
Caustic soda	39,133	12,800	Italy 10,578; Federal Republic of Germany 1,208.
Caustic potash	1,592	2,087	France 1,349; Spain 351; Federal Republic of Germany 106.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	716	436	Italy 350.
Other	2,307	179	NA.
Worked: Dolomite	35	1	NA.
Gravel and crushed rock	12,112	3,768	NA.
Limestone	115	56	NA.
Quartz and quartzite	26	34	NA.
Sand, excluding metal bearing	389	350	Federal Republic of Germany 97.
Sulfur:			
Elemental:			
Colloidal	10,236	1,250	United States 1,140; Federal Republic of Germany 62.
Other than colloidal	581,738	638,411	Canada 471,292; Poland 27,201; United States 25,089.
Sulfuric acid	48,302	62,102	Japan 48,632; Federal Republic of Germany 7,512.
Talc and steatite	1,958	1,744	Republic of Korea 964; Italy 229; United States 157.
Other:			
Crude	1,612	908	Australia 648.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	28,794	3,004	All from Canada.
Slag and ash, n.e.s	1,578	1,625	NA.
Oxides and hydroxides of magnesium, strontium, barium	381	175	United Kingdom 35; France 30; United States 26.
Iodine and fluorine	10	11	Japan 8.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	810	1,040	Austria 464; United States 239.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	520	604	United States 247; Netherlands 89.
Carbon black and gas carbon	3,104	2,825	Canada 863; United Kingdom 827; United States 625.
Coal, all grades, including briquets	295,662	198,593	NA.
Coke and semicoke	120	4	NA.
Gas, hydrocarbon, natural	27	28	France 13; United States 12.
Hydrogen and rare gases	26	23	United States 8.
Peat	549	316	Federal Republic of Germany 116.
Petroleum refinery products:			
Mineral jelly and wax thousand 42-gallon barrels	351	354	Japan 148; Federal Republic of Germany 72; United States 33.
Bitumen and other residues do	3,806	2,588	Netherlands 2,011.
Bituminous mixtures, n.e.s do	3,194	3,048	United States 1,351; United Kingdom 795.
Pitch do	165	968	United Kingdom 967.
Petroleum coke do	187,380	223,460	United States 136,048; United Kingdom 87,412.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	25	29	NA.

NA Not available.

[1] Less than 1/2 unit.

Table 4.—Republic of South Africa: Value of domestic sales and exports of major mineral commodities

(Thousand U.S. dollars)

Commodity	Domestic sales			Exports		
	1977	1978	1979	1977	1978	1979
METALS						
Aluminum	$80,913	$81,000	NA	$22,080	$26,910	$54,120
Antimony	9,941	9,269	$11,601	10,375	3,244	14,146
Chromite	41,361	31,357	44,181	71,103	70,354	61,957
Copper	60,619	72,398	123,328	179,995	169,442	227,097
Gold[1]				3,287,240	4,485,088	6,951,983
Hematite	37,466	57,357	78,355	189,384	188,946	262,995
Magnetite	4,142	5,536	8,307	5,357	856	--
Manganese	24,887	31,644	54,124	112,690	100,377	153,715
Nickel	13,983	15,199	11,265	86,410	87,630	39,234
Silver	14,498	16,899	35,548	--	--	--
Tin	6,640	8,740	10,958	21,096	25,729	23,983
Titanium	--	--	3,844	--	--	8,359
Uranium[1]	NA	NA	NA	104,424	244,958	308,057
Vanadium	22	39	47	60,524	61,180	77,369
Zinc	13,143	12,346	14,076	9,454	4,811	5,768
Zirconium	(2)	NA	NA	3,882	NA	NA
NONMETALS						
Andalusite	3,730	4,444	6,492	7,144	5,852	7,958
Asbestos	5,041	6,570	6,861	153,404	123,595	120,526
Cement	154,971	166,188	257,814	13,225	34,500	33,796
Flint clay	1,958	2,342	2,688	4,095	4,868	5,295
Other clay	4,914	6,522	7,994	114	50	50
Diamond[1]	--	--	--	296,232	512,656	651,373
Feldspar	1,343	1,897	2,078	187	302	321
Fluorspar	1,835	2,020	2,559	18,542	24,789	33,402
Granite	3,630	808	1,387	18,437	17,158	18,617
Gypsum	1,837	2,224	2,655	123	30	26
Limestone	33,167	38,252	46,209	103	160	165
Lime products	37,655	51,431	62,456	1,054	1,251	2,357
Magnesite	1,686	1,398	3,122	--	--	--
Mica	103	122	227	485	552	416
Phosphate rock	51,139	58,728	74,574	114	--	--
Pyrite-sulfur	11,259	9,070	10,044	--	637	98
Salt	8,491	11,300	13,938	378	1,020	1,825
Silica, sand	8,475	9,575	14,873	187	136	188
Sillimanite	181	286	808	1,717	1,726	2,537
Slate	995	1,055	1,137	383	1,153	1,890
Other stone	498	524	713	623	676	808
Vermiculite	213	217	222	6,526	8,398	8,229
Wonderstone	328	319	323	131	872	1,536
Miscellaneous	1,298	1,178	1,319	1,068	1,112	1,723
MINERAL FUELS						
Anthracite	13,207	14,648	23,599	56,691	63,733	93,786
Bituminous coal	569,676	617,144	731,202	229,148	310,090	512,077
Carbon black	8,280	8,395	8,925	--	--	--
Total	1,233,520	1,358,392	1,679,848	4,924,070	6,584,282	9,682,727

NA Not available.

[1] Value, if any, is included under "Exports."

[2] Less than 1/2 unit.

Sources: Republic of South Africa Department of Mines. Quarterly Information Circular, Minerals.
U.S. Consulate, Johannesburg, Republic of South Africa. State Department Airgrams A-56, July 31, 1979, Appendix C, and A-47, July 15, 1980, Appendix C.

COMMODITY REVIEW

METALS

Aluminum.—The country's only producer of primary aluminum, Alusaf (Pty.) Ltd., imported alumina from Alusuisse operations at Gove, Australia, and produced 76,000 tons of metal at its Richards Bay refinery where the capacity was increased from 78,000 to 85,000 tons per year in 1979. Alusaf, owned 66% by the Industrial Development Corp. Ltd., 22% by Alusuisse, 8% by Barlow Rand Ltd., 3% by Huletts Aluminium Ltd. (Hulamin), and 1% by Alcan Aluminum Ltd., produced aluminum as liquid metal and ingots for its affiliated fabricators. The adjacent Alustang (Pty.) Ltd. facility produced redraw rods and solid sector aluminum for electric cable. Hulamin produced flat and coil sheet, extrusions, cable, and paste for the paint industry at its four plants. During 1978, Hulamin contracted to use ISCOR's new $8 million coil coating line for the production of prepainted aluminum coil sheet for use in the vehicle and construction industries. Hulamin had an annual production capacity of 33,000 tons of aluminum sheet including a new facility producing 4,000 tons of thin-gage sheet for cold-drink cans at Olifantsfontein, Transvaal.

Imports of aluminum metal products, chiefly from the United States and the Federal Republic of Germany, increased from 1977 through 1979. Australia supplied most of the 18,000 tons of raw and activated bauxite required by the country's abrasives, chemicals, and refractories industries. The private-sector firm, South African Bauxite Ltd., reported 15 to 20 million tons of bauxite located in the Weza area as part of their Natal midlands reserves totaling 50 million tons at an average grade of 30% Al_2O_3. The exploitability of such bauxite was questionable.

Antimony.—Consolidated Murchison Ltd. (CML), owned 25% by Johannesburg Consolidated Investment Co. Ltd. (JCI), continued operations at its seven mines along the "antimony line" of the Murchison Range west and northwest of the Palabora copper mine. In 1978, ore and concentrate production and concentrate exports declined chiefly because of decreased demand for antimony in the battery and fire retardant industries. Both production and export of concentrates increased markedly in 1979. Local sales of antimony concentrates increased moderately to 8,832 tons. Local production of antimony oxide was halted during May, June, and July at the Antimony Products (Pty.) Ltd. plant at Gravelotte, owned jointly by Chemetron Corp. of Chicago, CML, and JCI.

Chromite.—Production of chromite increased in both 1978 and 1979, but total sales decreased to approximately $86 million in 1978 and then soared to more than $105 million in 1979. The country's chromite output was from some 17 producers operating along a number of parallel seams and bands of chromite in noritic rock of the Bushveld Igneous Complex in central Transvaal Province. Most of the mining was relatively inexpensive, because it required only shallow, underground, room-and-pillar mines and, except for the Grasvally and nearby mines, the iron-to-chrome ratio was high. Export facilities at Durban and Richard's Bay were underutilized in respect to chromite as most of the ore was handled through the port of Maputo in Mozambique.

The Transvaal Consolidated Land Exploration Co. Ltd., owned 59% by Barlow Rand Ltd., started to expand production from recently developed extensions of its Winterveld (T.C.L.) Chrome Mines Ltd. property near Steelport, north of Lydenburg. The Southern Sphere Mining and Development Co. (Pty.) Ltd., a subsidiary of Utah International, and TG Exploration Ltd. and Pandora Mining Pty. Ltd., both subsidiaries of Texasgulf Inc., were negotiating a joint venture to apply Texasgulf's new smelting technique, the Expanded Precessive Plasma (EPP) process, to unexploited chromite-platinum deposits of the Bushveld Complex.

In August 1977, Armco (Pty.) Ltd., a subsidiary of Armco Steel Corp., acquired mineral rights in the Marico District west of Rustenburg. Armco subsequently agreed with Vereeniging Refractories Ltd., a subsidiary of Anglo American Corp. and the owner of adjacent properties, for the joint operation of a new mine. Initial capacity was scheduled at 120,000 tons per year of chromite, chiefly for export to Armco Steel Corp.

Copper.—Production of copper increased marginally, and the average world market price increased slightly during 1978. In 1979 the price improved substantially but preduction dropped, and the value of exports soared to more than $225 million. In 1978, the Republic's reserves of copper ore were estimated by the Minerals Bureau of the Department of Mines as follows:[4]

Area	Million tons	Percent	Copper metal (Tons)
Cape Province:			
O'okiep	27.198	1.67	454,200
Prieska	48.000	1.74	835,200
Black Mountain	80.000	.80	640,000
Broken Hill	60.000	.40	240,000
Transvaal Province:			
Messina	4.300	1.37	59,000
Palabora	509.091	.55	2,800,000
Total or average	728.589	.69	5,028,400

The Merensky Reef's 1,712.5 million tons of platinum-nickel ore containing 0.08% copper was added to the above totals to yield an additional 1.37 million tons of copper metal.

The mines operated in northwest Cape Province by O'okiep Copper Co., owned 57.7% by Newmont Mining Corp., produced 1.8 million tons of ore in both 1978 and 1979, but the copper content decreased from 1.35% to 1.29% in 1979. The O'okiep smelter treated only 38% in 1978 and less than 38% in 1979 of the copper concentrate produced by Prieska Copper Mines (Pty.) Ltd., instead of the 57% handled in 1977. This shortfall accounted for O'okiep's drop in blister copper production from 43,088 tons in 1977 to 41,561 tons in 1978 and to 32,105 tons in 1979, the lowest figure reported in more than 20 years. Prieska, jointly owned by Anglo Transvaal Consolidated Investment Co. Ltd. and U.S. Steel Corp., reported increases in both ore and copper concentrate production to 3 million tons and 127,700 tons, respectively.

Messina Transvaal Development Co. Ltd. reported its fourth consecutive year of declining production and a loss of $500,000 in 1978 from its northern Transvaal mines. Ore production declined to 669,000 tons, and the copper content of its concentrate dropped to 7,300 tons. The operation was granted state assistance to accelerate new development and increase production. In 1979 Messina returned to profitability because of improved copper prices although only 610,000 tons of ore containing 1.12% copper was hoisted and milled.

Development of an underground mine to exploit the Broken Hill ore body on the Aggeneys farm in northwest Cape Province, west of Pofadder, continued by Phelps Dodge Corp. and GFSA. Production of 20,000 tons per year of copper concentrates plus silver, and larger quantities of lead and zinc concentrate was scheduled to begin in 1980.

Palabora Mining Co. Ltd. reported an increase to 27 million tons of ore milled in 1978 and 1979 at its open pit operation in northeastern Transvaal. Copper concentrate production and sales revenue increased, reflecting price improvements. Vermiculite sales rose owing to improving economic conditions, but magnetite sales dropped sharply as the last shipment of magnetite to Japan under a 10-year contract was made in September 1978. Approximately 45% of Palabora's copper was sold domestically, the balance being exported. In 1979 Palabora announced plans to increase its mining rate from 300,000 to 355,000 tons per day and to increase its pit diameter by an average of 200 meters at the surface and extend its depth by 100 meters to an ultimate depth of 774 meters. Production of the Palabora Copper Co. for 1977, 1978 and 1979 was as follows, in tons:

	1977	1978	1979
Ore and waste mined	89,480,000	90,030,000	86,214,000
Ore milled	24,864,000	27,474,000	27,077,000
Concentrate produced	307,248	330,883	296,295
Copper in concentrate	109,503	118,641	111,872
Sales:			
Copper	104,231	114,878	112,667
Magnetite	435,293	116,597	70,447
Sulfuric acid	120,615	116,759	103,139
Vermiculite	154,380	193,046	178,022
Total sales value, millions	$164	$186	$261

Gold.—The gold industry of the Republic of South Africa enjoyed the most successful and lucrative years in its history in 1978 and 1979. The reported value of production rose to new records in both years as the average sales price climbed. Production figures of the major mines or companies for 1977, 1978, and 1979 are shown in table 5.

Table 5.—Republic of South Africa: Gold production and ore reserves

Producer	Production (troy ounces)			Developed ore	
	1977	1978	1979	Thousand metric tons	Troy ounces per metric ton
Barberton	49,081	51,856	48,496	NA	NA
Blyvooruitzicht	660,424	628,242	605,363	5,020	0.711
Bracken	182,124	168,550	139,235	2,500	.158
Buffelsfontein	925,478	899,983	836,183	8,870	.375
Crown Mines	11,118	--	--	--	--
Doornfontein	397,255	403,968	388,285	2,370	[illegible]
Durban Deep	241,465	272,584	243,683	4,529	.186
East Driefontein	1,570,483	1,565,474	1,555,816	6,636	.701
East Rand Proprietary Mine	320,913	337,917	345,373	6,832	.244
Elandsrand	--	--	94,240	504	[illegible]
Free State Geduld	1,405,952	1,366,069	1,210,180	8,651	[illegible]
Free State Saaiplaas	148,774	139,177	140,772	1,997	.186
Grootvlei	211,497	194,952	216,837	4,100	.157
Harmony	1,020,979	985,227	1,037,697	19,767	[illegible]
Hartebeestfontein	1,022,583	1,014,751	1,023,213	11,969	.415
Kinross	373,862	361,815	309,599	6,300	[illegible]
Kloof	654,428	850,281	1,008,334	2,865	.543
Leslie	131,850	137,184	129,066	3,200	.148
Libanon	449,339	430,701	400,431	2,713	.540
Loraine	256,209	229,235	197,714	3,880	[illegible]
Marievale	110,701	87,029	58,926	200	.165
President Brand	996,123	977,687	985,719	9,588	.422
President Steyn	834,736	816,188	835,476	18,576	[illegible]
Randfontein	561,030	678,577	755,079	5,680	[illegible]
St. Helena	623,946	552,703	552,520	10,900	[illegible]
Stilfontein	527,336	583,091	532,265	5,436	.344
Unisel	--	--	38,591	700	[illegible]
Vaal Reefs	2,001,589	2,168,182	2,163,153	25,223	.397
Venterspost	230,521	211,578	199,611	2,098	.376
Vlakfontein	68,417	--	--	--	--
Welkom	444,436	420,368	393,538	6,092	[illegible]
West Driefontein	1,697,093	1,840,797	1,679,992	5,555	[illegible]
Western Areas	690,437	745,870	742,971	11,767	[illegible]
Western Deep Levels	1,397,892	1,467,913	1,539,689	5,397	[illegible]
Western Holdings	1,144,669	1,044,520	997,101	9,174	[illegible]
West Rand Consolidated	186,094	107,422	75,037	410	[illegible]
Winkelhaak	511,833	504,678	489,501	9,400	[illegible]
Witwatersrand Nigel	41,632	36,176	37,137	946	[illegible]
Anglo American Joint Metallurgical Scheme	10,365	46,940	62,809	NA	NA
Other producers	879,118	371,428	547,030	NA	NA
Total, all producers	22,501,886	22,648,558	22,616,656	224,854	.367

[r] Revised. NA Not available.

Sources: Chamber of Mines of South Africa. Quarterly Analysis of Working Results, October-December 1978, 1979. U.S. Consulate General. Johannesburg, Republic of South Africa. State Department Airgram A-47, July 15, 1980, pp. 45 to 48.

Five of these mines accounted for more than one-third of the country's gold production and each produced more gold than the entire United States. Most of the mines produced their own bullion containing approximately 88% gold, 10% silver, and 2% base metals in bars weighing from 800 to 870 troy ounces. The bars were then delivered to the Rand Refinery at Germiston where they were assayed and purchased on behalf of the South African Government's Reserve Bank. The producing mines were paid promptly (within 5 days) by the Reserve Bank at the world market price of gold on the date of delivery.

Although the Republic of South Africa is responsible for about 60% of the world's gold output, its gold mining industry consisted of about 35 large underground operations and two major tailings retreatment plants. Most of these were controlled or managed by seven large corporations with interlocking shareholdings and extensive mineral and industrial holdings both inside and outside South Africa. These corporations were Anglo American Corp. of South Africa Ltd. (AAC), Anglo Transvaal Consolidated Investment Co. Ltd. (Anglovaal) Barlow Rand Ltd., General Mining and Finance Corp. Ltd., Gold Fields of South Africa Ltd. (GFSA), Johannesburg Consolidated Investment Co. Ltd. (JCI), and Union Corporation Ltd.

AAC's Elandsrand mine began commercial production in December 1978, 2 years ahead of schedule. Most of the output was reportedly derived from preproduction development work, and the design capacity of 180,000 tons per month of ore was reached with the installation of three autogeneous mills by mid-1979. GFSA's Deelkraal Shaft No. 1 was fully equipped to a depth of 2,037 meters, and the subvertical incline was sunk to a depth of 427 meters. The refrigeration plant, reduction works, and other major surface installations were complete. Milling on a trial basis began in December 1979.

AAC's Joint Metallurgical Scheme treated slimes from six of its mines in the Welkom area of the Orange Free State. The main facility was the rehabilitated uranium plant and flotation complex at the President Brand Mine, which had the capacity to treat 350,000 tons of slimes per month and to recover gold, in addition to uranium and pyrite for byproduct sulfuric acid. Production for both 1978 and 1979 was below expectations. The East Rand Gold and Uranium Co. Ltd. (ERGO) was formed by AAC to recover low concentrations of gold, uranium, and pyrite from old slimes and tailings dams in the Witwatersrand area of Transvaal Province. Sulfuric acid was produced by roasting the pyrite concentrated from the tailings; gold, copper, and other metals were recovered by leaching the sinter. The first uranium salts were produced in February 1978, the first charge of pyrite into the roaster of the 1,000-ton-per-day sulfuric acid plant was made in March 1978, and the first gold bullion was poured in April 1978. Production for the year included nearly 85,000 troy ounces of gold, 115 tons of U_3O_8, and 240,000 tons of sulfuric acid.

JCI commissioned the Cooke section gold and uranium treatment facilities of its Randfontein mine southwest of Johannesburg in 1978. A total of $230 million was spent on rehabilitation of the old Randfontein mine and mill and construction of the new Cooke section. The refurbished uranium plant at Millsite was operating satisfactorily at the Randfontein section, but at the Cooke section, the mill failed to reach its targeted capacity because of corrosion and mechanical difficulties. JCI was also investigating the feasibility of opening still another large mine in the Randfontein Estates area despite the possible closure of the South Roodepoort and Durban Deep mines in the vicinity.

Iron Ore and Concentrate.—In 1978, production of iron ore decreased from that of the record year 1977, which marked the startup of the Sishen-Saldanha Bay export project. Exports decreased slightly, both in volume and in value, and the quantity of iron ore sold on the local market increased to 16 million tons in 1978. The following year, new records were set in both quantity and value of production, exports, and local sales.

The Government-owned Iron and Steel Industrial Corp. Ltd. (ISCOR) was the Republic's largest producer of hematite ore from its mine in the Sishen area in northern Cape Province. In 1973, ISCOR initiated a development program which included a new mine and facilities, an 861-kilometer railroad, and a modern ore-loading port at Saldanha Bay. Production capacity at Sishen was doubled to 27 million tons of iron ore per year. Approximately 15 million tons per year was to be exported with the remainder supplied to ISCOR's steelworks at Vanderbijlpark, Newcastle, and Pretoria. ISCOR operated a second mine at Thabazimbi in northwestern Transvaal, which supplied iron ore to the Pretoria Works. The Thabazimbi operation had an annual production capacity of 3 million tons. Associated Manganese Mines of South Africa Ltd. and Consolidated African Mines Ltd. were other major hematite producers.

Magnetite ore accounted for about one-sixth of the total iron ore production in 1978 and was primarily for domestic consumption. Magnetite exports decreased in 1978 owing to the completion of several sales contracts with Japanese steel producers including Palabora Mining Company's 10-year sales contract with Kobe Steel Ltd. Magnetite was produced as a byproduct from the processing of carbonatite copper and phosphate ores, primarily by the Palabora Mining Co. and the Phosphate Development Corp. in eastern Transvaal.

Iron and Steel.—ISCOR accounted for 85% of South Africa's liquid and pig iron production and 76% of the country's output of steel products in 1978. Total liquid and pig iron production increased marginally in 1978 while output of steel ingot increased and production of steel and iron castings declined. However, higher export volume and rising steel prices increased the total value of pig iron and prime steel products from $1.2 billion in 1977 to $1.5 billion in 1978. The value of all iron and steel commodities increased during 1979 to a total value of $2.23 billion.

ISCOR reported a record loss of $84 million for the fifth consecutive deficit year ended June 30, 1978, and a moderate ($45.1 million) loss for 1979, owing largely to debts incurred for its ongoing expansion program. Production capacity of liquid steel was to be increased from 7 million tons per year to 11 million tons per year by 1982. Production capacity was allocated among the company's steelworks as follows: Vanderbijlpark, 5 million tons per year; Newcastle, 4 million tons per year; and Pretoria, 2 million tons per year.

Highveld Steel and Vanadium Corp. was the leading producer of specialty steel and products at its integrated steelworks in Pretoria. Highveld set new production and earnings records when steel sales rose 25% to approximately 632,000 tons in 1978. Production capacity was rated at 750,000 tons per year. Southern Cross Steel Co. (Pty.) Ltd. was the only producer of primary stainless steel at its Middleburg, Transvaal, facilities. Production in 1978 consisted of 5,000 tons of stainless steel finished sheet and 15,000 tons of plate increasing somewhat by 1979 when major expansion plans were announced. Approximately 50% of the output was sold locally and 50% exported. Union Steel Corp. Ltd. (USCO) completed tests for the manufacture of alloy tool and specialty steels not previously manufactured in South Africa and commenced local sales of these products in late 1978. USCO, with current assets of $45 million, reported a $4 million net profit on sales of $160 million in mild steel sections, special steels, forgings, and castings.

Ferroalloys.—The ferroalloy industry had record years in 1978 and 1979 when total production rose and export earnings increased by half to $352 million. Almost all production was exported to the steel-producing countries of the United States, Japan, and Western Europe. The most significant ferroalloys produced in terms of both importance in world supplies and export earnings were ferrochrome, used mainly in the stainless steel industry, and ferromanganese, used mainly in the carbon and alloy steel industries.

South African Manganese Amcor Ltd. (SAMANCOR) accounted for about 40% of the 1978 production of ferroalloys. SAMANCOR's facilities at Meyerton, Transvaal, produced ferromanganese, ferrochrome, and ferrosilicon. Other important producers of ferromanganese were ISCOR, Associated Manganese Mines Ltd., Highveld Steel and Vanadium Corp., and Anglovaal.

Two new producers of ferrochrome moved into full production. Consolidated Metallurgical Industries Ltd. (CMI), a subsidiary of JCI, operated its 120,000-ton-per-year plant at Lydenburg, Transvaal, at full capacity in 1978. Tubatse Ferrochrome (Pty.) Ltd., a joint venture of Union Carbide and General Mining and Finance Corp. Ltd., reached its full production capacity of 120,000 tons per year in 1979. Palmiet Chrome Corp. (Pty.) Ltd. discontinued production of low-carbon ferrochrome at its plant in Krugersdorp, Transvaal. Other producers of ferrochrome were Anglovaal and Southern Cross Steel Co. Ltd.

Manganese.—Manganese production declined in 1978 compared with 1977 output owing primarily to continued recession in the world iron and steel industry and strong competition from other manganese producers. However, the Republic of South Africa ranked second only to the U.S.S.R. in the volume of production and remained the free world's largest exporter of manganese. Approximately two-thirds of production was exported in 1978, chiefly to Japan, France, the United States, the United Kingdom, the Federal Republic of Germany, and Norway. The ferroalloy industry was the major local consumer of manganese ore. Small quantities were also sold on the local market to the chemical industry and to the electrolytic manganese plant at Nelspruit, operated by Delta Manganese (Pty.) Ltd. A decline in exports in 1978, coupled with lower prices, led to a decrease in total sales revenue in 1978, but these trends were reversed in 1979.

Important manganese occurrences were found in the Postmasburg Field, the Kuruman or Kalahari Field, and in the vicinity of the Witwatersrand goldfields. Since the early 1970's, local manganese mining capacity has greatly increased as a result of expansions to existing mines and the establishment of new mines. Capacity was further increased in 1979 when AAC brought onstream the new Middelplaats underground mine located near Kuruman in northern Cape Province. Installed capacity of the mine was scheduled at a rate of 1.1 million tons per year of manganese ore by mid-1980.

SAMANCOR was the largest producer of manganese ore with annual production capacity of about 4 million tons per year. SAMANCOR operated the large Wessels underground mine, recently expanded to a 500,000-ton-per-year capacity, and three open pits - Hotazel, Mamatwan, and Lohathla. In September 1979 SAMANCOR reportedly was importing some 20,000 tons of low (6.5%) iron, high (54%) manganese pellets from Amapa, Brazil, for blending with ore from SAMANCOR's Wessels Mine to make an acceptable feed for the ferromanganese plant at Kookfontein operated by its subsidiary, Metalloys Ltd. The results of the blend was compared with the normal production of Mamatwan ore at 7% iron and 40% manganese. Associated Manganese Mines of South Africa Ltd. was the country's second-largest producer with an annual production capacity of 2 million tons per year of ore. The main Mancorp Mine and other smaller mines were located in the Kalahari Field's Black Rock area.

During an independent study of the manganese ores of Cape Province in 1978, SAMANCOR's analysts concluded that the recoverable and salable ores of the Postmasburg and Kuruman Fields are larger and more important than had been previously estimated by the South African Geological Survey and others. Specialists from the Minerals Bureau of South Africa's Department of Mines confirmed the superior reliability of the new estimates and have suggested their use in respect of the country's proved and probable ore in situ.[5] These reserves are as follows, in tons:

More than 44% Mn	310,800,000
40% to 44% Mn	30,000,000
30% to 40% Mn	7,181,000,000
20% to 30% Mn	4,618,000,000
Total	12,139,800,000

Nickel.—Nickel production was a byproduct of platinum mining in the Merensky Reef in the prolific Bushveld Igneous Complex of the central Transvaal. Although platinum production declined slightly in 1978, improved nickel grade and recoveries resulted in a slight production increase over the 1977 level. Approximately 88% of refined nickel production was exported to captive buyers in Norway, Canada, the United Kingdom, and the United States. Local sale of nickel was primarily to the stainless steel industry.

Nickel was recovered by the refining of nickel-copper matte at an approximate ratio of 1 ton nickel to 55 troy ounces of platinum metal. Nickel production capacity of the major platinum producers was as follows: Rustenburg Platinum Mining Co. Ltd., 10,000 tons per year; Impala Platinum Mines (Pty.) Ltd., 10,000 tons per year; and Western Platinum Ltd., 3,000 tons per year. In 1978 and 1979 Rustenburg modified their plant to separate cobalt from nickel and produced about 75 tons of cobalt sulfate in 1979.

Platinum.—Although production of platinum-group metals decreased slightly from the 1977 level in 1978 and increased in 1979, the Republic of South Africa remained the world's largest producer. Higher world prices meant increased profits for the country's three platinum producers, who milled a total of 15.1 million tons and 15.9 million tons of ore in 1978 and 1979, respectively. Virtually all platinum production was exported at prices increasing steadily from $195 per ounce in January 1978 to $645 in December 1979. South Africa was estimated to have at least 50% of the world's known recoverable resources of platinum in the Merensky Reef of the Bushveld Igneous Complex.

Rustenburg Platinum Mining Co. Ltd., the world's largest producer of platinum metal, expected to raise annual production capacity from 900,000 troy ounces in 1978 to 1.2 million troy ounces in 1980. Rustenburg planned to develop the Amandelbult mine to replace output from the high-cost workings at the Union section. The country's second-largest producer, Impala Platinum Mines (Pty.) Ltd., had a annual capacity of approximately 750,000 troy ounces of platinum metal. Western Platinum Ltd., operated by Lonhro Ltd., produced platinum matte at a smaller mine near Brits.

Tin.—As world tin prices approached record levels, the country's three tin producers initiated new development plans. In 1978, the production of tin concentrate decreased marginally and the quantity exported declined, but export value increased. In 1979 there was further reduction in concentrate production and both the quantity and value of exports declined markedly. Production of tin metal, which was consumed locally, increased in quantity and in value in both years. South Africa's tin production by company for the years 1977, 1978, and 1979 was as follows, in tons:

Company	1977		1978		1979	
	Ore	Concentrate	Ore	Concentrate	Ore	Concentrate
Rooiberg Minerals Development Co. Ltd	135,437	4,563	117,792	4,523	136,460	3,975
Union Tin Mines Ltd	34,333	1,268	47,285	1,317	49,868	1,467
Zaaiplaats Tin Mining Co. Ltd	73,500	308	75,500	279	78,189	264
Total	243,270	6,139	240,577	6,119	264,517	5,706

The Rooiberg field, located 56 kilometers west of Warmbaths, accounted for more than two-thirds of the tin concentrates produced in 1978. Annual capacity was 2,300 tons of tin in concentrates, and underground mine development was in progress. Rooiberg was constructing a 2,000-ton-per-year smelter, which was expected to reduce exports of tin-in-concentrates markedly when it was commissioned in 1980.

Zaaiplaats Tin Mining Co. Ltd. was the smallest producer of tin ore and concentrate from its field extending 21 kilometers along the Makapansberg Range. Zaaiplaats operated the country's independent tin smelter near Potgietersrus, Transvaal. During the year, Zaaiplaats began a tailings retreatment project which was expected to have an output of 50 tons per year of tin.

High tin prices prompted Union Tin Mines Ltd. of GFSA to postpone the phasing out of its operation. It was reported that the company inaugurated a new development program in 1978 and 1979 to exploit additional reserves, and continue flotation retreatment of mine dumps.

Uranium.—Two new uranium reclamation projects and renewed emphasis on uranium recovery owing to increased prices led to production increases in the last few years. Approximately 15 of the more than 40 Witwatersrand gold mines recovered uraninite as a byproduct in 1978 when production of U_3O_8 from gold ores increased 18% to 4,531 tons. The average grade of gold ore treated declined marginally from 0.182 kilogram U_3O_8 to 0.175 kilogram U_3O_8 per ton of ore treated. Table 6 shows the 1977, 1978, and 1979 production of U_3O_8.

Table 6.—Republic of South Africa: Production of U_3O_8, by producer

(Kilograms)

Company or mine	1977	1978	1979
Blyvooruitzicht	199,949	292,212	285,710
Buffelsfontein	653,200	620,000	620,400
Harmony	535,820	534,839	540,955
Free State Saaiplaas	45,545	--	--
Hartebeestfontein	377,405	365,889	394,210
Randfontein	3,635	96,081	412,909
Vaal Reefs	1,016,955	1,059,851	1,273,416
West Driefontein	295,567	295,119	288,274
Western Deep Levels	167,410	183,365	190,002
West Rand Consolidated	265,559	312,914	367,512
Anglo American JMS	312,750	635,059	676,252
Palabora Copper	88,661	140,860	121,388
Miscellaneous	--	117,828	457,979
Total	3,962,456	4,672,017	5,637,000

All uranium production was exported in 1978. Most uranium producers, with the exception of Palabora Mining Co., sold their output through the Nuclear Fuels Corp (NUFCOR), a consortium of AAC, Anglovaal, General Mining, and Union Corp. Production was marketed by the Chamber of Mines of South Africa. The value of uranium exported increased from $104 million in 1977 to $245 million in 1978.

Uraninite and other radioactive minerals occurred primarily in association with gold-bearing reefs or in copper-bearing carbonatites. In 1978, reserves were estimated at 325,500 tons of U_3O_8 considering uranium as a byproduct of gold and copper processing at a base price of $30 per pound of U_3O_8 and at current operating costs.

AAC's East Rand Gold and Uranium Co. Ltd. (ERGO) came onstream in 1978 at an estimated development cost of $167 million. ERGO was to recover low concentrations of gold, uranium, and pyrite from previously abandoned slimes dams at Transvaal mines east of Johannesburg. Approximately 1 million tons per month of slimes was to be treated to recover 54% of the contained gold, 20% of the contained uranium, and 86% of the contained sulfur. Annual production was to consist of 200 tons of uranium, 225,000 troy ounces of gold, and 530,000 tons of sulfuric acid. After nearly 2 years of operation the monthly target was established at 14,725 troy ounces of gold, 16.7 tons of U_3O_8, and 37,500 tons of sulfuric acid.

AAC's Orange Free State Joint Metallurgical Scheme moved closer to full production in 1978 and 1979 when production approached the 700 tons U_3O_8 mark. Participants in the project to recover gold, uranium, and sulfur from slimes and tailings included Free State Geduld, Free State Saaiplaas, President Brand, President Steyn, Welkom, and Western Holdings mines. Technical difficulties in the treatment plant limited initial throughputs, which were expected to total 1.5 million tons per month of slimes.

Randfontein Estates Gold Mining Co. Ltd. operated by JCI, registered the largest gains in 1978 and 1979 when production increased from 4 to 96, and then to 418 tons U_3O_8 in 1977, 1978, and 1979, respectively. During 1978, the Randfontein section of the mine was reopened, and the company started producing from the new Cooke section. Anticipated monthly capacity of 250,000 tons of ore, in addition to 100,000 tons of slimes, was achieved in 1979.

In 1978, Union Corp. announced plans to develop South Africa's only mine at which uranium would be recovered as a primary product with gold as a byproduct. Beisa Mines Ltd., a Union Corp. subsidiary, was to operate the mine located in the vicinity of the Harmony property about 25 kilometers south of Welkom in Orange Free State. Ore reserves were reported to contain 0.5 kilogram of U_3O_8 and 0.225 troy ounce of gold per ton. The plant was to treat 100,000 tons per month of ore at the underground operation by 1982.

Uranium production was expected to double by the 1980's as new treatment plants came onstream and uranium exploration continued. General Mining continued construction of its new $69 million uranium plant at Stilfontein Mine. Rand Mines announced plans to construct a new uranium plant at the Merriespruit section of Harmony Mine. GFSA, AAC, General Mining, and Union Corp. continued drilling programs in Orange Free State. Apart from exploration and development in the gold and uranium bearing areas, exploration in the Karroo Desert, northeast of Capetown, was intensified. Three U.S. companies were working in this region, Esso, Union Carbide, and Newmont, as well as AAC, and JCI of the Republic. Interest was centered on channel deposits with uranium minerals in rocks of Karroo (Permian-Trassic) age.

Vanadium.—Worldwide over-capacity led to cutbacks in vanadium production by the country's major producers in 1977 and 1978. With production remaining at the 1977 level, the Republic of South Africa continued as the world's largest producer of vanadium, accounting for nearly one-half of world production. The value of vanadium production increased slightly, although prices remained at low levels in 1978. Both quantity and value increased in 1979. Production statistics combined the V_2O_5 content of several products - pentoxide, ferrovanadium, metavanadate, and slag. Virtually all vanadium production was exported, since local sales continued to be weak.

The principal source of vanadium was in the titaniferous magnetite deposits in the Bushveld Igneous Complex of central Transvaal with the most important deposits occurring in the general vicinity of Lydenburg. The country's largest vanadium producer (and the leading world producer of this commodity) was Highveld Steel and Vanadium Corp. Ltd. Highveld had an annual capacity of 12,000 tons of vanadium pentoxide with ore originating from the Steelport-Roossenekal area of the Transvaal and treated at Witbank. Ucar Minerals Corp. Ltd. of Union Carbide SA Ltd. had an annual capacity of 2,000 tons of vanadium pentoxide from its plants at Brits and Bon Accord near Pretoria. The remaining producer was Otavi Mining Co. Ltd., which produced 1,500 tons per year of vanadium pentoxide at its plant near Wapadskloof in Transvaal.

Zinc.—Zinc concentrate production from a single operating zinc mine decreased in both 1978 and 1979 but zinc prices improved substantially in 1979. Prieska Copper Mines (Pty.) Ltd., was in its sixth year of operation as a four-product mine and concentrator with recoveries of copper, zinc, lead, and pyrite. Prieska sold zinc concentrate locally to GFSA's Zinc Corp. of South Africa Ltd.

(ZINCOR), which produced 79,000 tons of electrolytically refined zinc from domestic and imported concentrates. Approximately 42,000 tons of zinc concentrate was exported under contract to Metallgesellschaft (Federal Republic of Germany) in 1978.

Zinc production was to be augmented in the 1980's by output from a new mine developed by Phelps Dodge, in conjunction with GFSA. Reserves at the Black Mountain deposit near Aggeneys in northwestern Cape Province were estimated at 38 million tons of ore containing 0.45% copper, 6.25% lead, 2.87% zinc, and 0.08% silver. Annual production capacity of the mine was expected at 1.1 million tons of ore with recoveries of 22,000 tons of copper concentrate, 132,000 tons of lead concentrate, 35,000 tons of zinc concentrate, and 2.6 million ounces of silver.

A joint venture consisting of Newmont Mining Corp. (27.5%), O'okiep Copper Co., (27.5%), and AAC (45%), postponed exploitation of their large zinc deposit near Gamsberg in Namaqualand. Reserves were estimated at 143 million tons of ore containing 7% zinc and 0.5% lead.

NONMETALS

Andalusite and Related Minerals.—The Republic of South Africa continued as the world's leading producer of andalusite and a significant producer of sillimanite. The combined value of the two commodities was approximately $12 million and $16 million in 1978 and 1979, respectively. Local sales consumed more than one-half the country's output of andalusite, but less than one-fourth of the sillimanite production was sold locally. The country's andalusite production has nearly trebled since 1970 and was expected to continue rising. Large reserves occurred in the Groot Marico-Zeerust area, the Thabazimbi area, and the Lydenburg District. In 1978, Hudson Mining Co. (Pty.) Ltd. was the largest producer of andalusite in the country and one of the largest in the world. Hudson's operation at Burgersfort near Lydenburg in eastern Transvaal had an annual production capacity of 50,000 tons per year. Other large producers were Havercroft Andalusite Co. (Pty.) Ltd. with a 36,000-ton-per-year operation near Lydenburg, and Cullinan Minerals (Pty.) Ltd. with a 12,000-ton-per-year mine at Welverdieng in western Transvaal.

Sillimanite production was notable for its high alumina content (60%) and lumpy form. Production has declined in recent years but was expected to remain constant after 1978 until available reserves were depleted. Two companies produced sillimanite in Namaqualand: Pella Refractory Ores (Pty.) Ltd. at Pella Mission and R. G. Niemoller (Pty.) Ltd. at Klein Pella.

Asbestos.—Production and exports of asbestos were well below 1977 levels owing primarily to weak world demand. The Republic of South Africa was a major source of the crocidolite, amosite, and chrysotile varieties of asbestos produced largely in the Transvaal and Cape Provinces. Cape Blue crocidolite was the country's most important variety and traditionally accounted for well over one-half of the value of annual asbestos sales. In 1978 and 1979, production and export declines were evidenced in all major categories of asbestos.

Of South Africa's 17 or more asbestos producers, three companies accounted for the majority of production. General Mining and Finance Corp. Ltd. owned two asbestos-producing subsidiaries, Griqualand Exploration and Finance Co. Ltd. and Msauli Asbes Beperk. Griqualand produced about 50,000 tons per year of crocidolite fiber from operations in the Kuruman District of Cape Province. In 1978, the company closed its Brethy Mine but maintained normal operations elsewhere. A Msauli property, with a production capacity of 85,000 tons per year at Barberton in Transvaal, was the country's largest producer of chrysotile asbestos.

Cape Asbestos South Africa (Pty.) Ltd. administered Cape Blue Mines (Pty.) Ltd. and Egnep (Pty.) Ltd. Cape Blue produced blue crocidolite at its mines in northern Cape Province. The expansion and modernization of the Pomfret Mine (70,000 tons per year) was completed in August 1978. Egnep operated the recently modernized Penge Mine (100,000 tons per year) in Lydenburg district, in Transvaal Province, which continued as the world's leading amosite producer.

Kuruman Cape Blue Asbestos (Pty.) Ltd. and Danielskuil Cape Blue Asbestos (Pty.) Ltd. were subsidiaries of Asbestos Investment (Pty.) Ltd., owned by the European Eternit Group. Kuruman produced 30,000 tons per year of crocidolite at Whitebank and 18,000 tons per year in the Postmasburg District. Danielskuil operated a 15,000-ton-per-year mine in Cape Province.

Diamond.—Overall production of diamond (gem and industrial) increased marginally in 1978 and 1979 but the output value increased substantially. This rise in value per carat reflected continued world market price increases of 30% in 1978 and 15% in 1979 implemented by the De Beers Central Selling Organization, which controlled external sales of the country's diamond production and reportedly marketed about 80% of the world's diamond per year. In 1978, the volume of diamond sales decreased, while overall value increased more than 150%. Both volume and value showed substantial increases in 1979. Table 7 shows the marketed output of diamonds in carats and the average prices per carat realized for diamonds from various sources in the Republic of South Africa.

Table 7.—Republic of South Africa: Marketed diamond output, by type and province

Type and province	1977		1978		1979	
	Output (carats)	Price per carat	Output (carats)	Price per carat	Output (carats)	Price per carat
Mine diamond:						
Transvaal	2,033,790	$12.90	1,940,755	$31.95	2,033,993	$30.60
Cape Province	3,627,912	25.22	3,593,972	44.38	3,680,787	45.58
Orange Free State	455,780	84.37	408,802	113.97	441,050	117.34
Total	6,117,482	25.53	5,943,529	46.10	6,155,830	48.75
Alluvial diamond:						
Transvaal	10,014	154.85	16,274	294.18	22,268	325.21
Cape Province	1,338,906	103.42	1,430,273	168.17	1,995,046	172.45
Orange Free State	34	434.29	23	26.00	7	261.80
Total	1,384,954	103.81	1,446,570	169.07	2,017,321	174.13
Grand total	7,466,436	34.50	7,390,099	69.37	8,173,151	79.70

De Beers accounted for approximately 93% of South Africa's diamond production and 17% of world diamond production in 1978. The largest producing mines were the Finsch Mine in Cape Province, which produced 2.63 million carats in 1978 and 2.58 million carats in 1979, and the Premier Mine in Transvaal Province, which produced nearly 2 million carats in 1978 and 2.08 million carats in 1979. Both mines were to undergo expansion of production capacity. At the Finsch Mine, output was to be increased to 3.5 million carats annually by 1980 and capacity of the treatment plant was to increase 40%. At the Premier Mine, extraction of diamondiferous kimberlite from below a 100-meter-thick barren gabbro sill was initiated in 1978. This block, which was estimated to contain 14 million tons of kimberlite, was expected to greatly extend the life of the mine. A notable event for the 1978 diamond industry was finding, studying, and cutting the 353.9-carat Premier Rose diamond. The Mouw Diamond Cutting Works (Pty.) Ltd. bought the rough stone for $4.25 million, and cut it into three top-color stones of 137.02 carats, 31.48 carats, and 2.11 carats, which were subsequently exported and sold for approximately $6.0 million. In 1979 a 74.13-carat alluvial stone of exceptional quality was found at the Alexander Bay diggings and the uncut gem sold for about $10,000 per carat.

The Namaqualand mines production increased as a result of the commissioning of the Koingnaas Mine in August 1978. The open pit alluvial deposit was expected to reach a production capacity of 750,000 carats per year by 1980. Ore reserves were estimated at 15.5 million tons.

Cement and Limestone.—The growth in domestic demand led to an increase in the 1978 production of lime and limestone which was reversed in 1979. Although domestic sales of cement declined in both years, their value increased owing to higher cement prices. Total cement production was only slightly down in 1978, but increased in 1979. Exports of all three commodities increased in 1978 with cement exports nearly doubled. In 1979 cement exports declined in both volume and value. Imports of specialty cements increased drastically in 1979, with the value of imports from France showing a tenfold increase to about $2 million, while the value of imports from the United States declined to less than $8,000.

Four major companies accounted for over 85% of domestic limestone and cement production. Anglo Alpha Cement Co. Ltd. was the country's largest cement producer from its 1.9-million-ton-per-year Dudfield plants in Lichtenburg, its smaller Ulco plant in Kimberley, and plants at Phillipi and Roodeport, as well as its 500,000-ton-per-year plant at Ouplaas, about 160 kilometers west of Kimberly. Other major producers were Pretoria Portland Cement Co.

Ltd., and Cape Portland Cement Co. Ltd.

Fluorspar.—Output of fluorspar increased to new record production levels in both 1978 and 1979 making South Africa one of the world's leading producers and exporters of this commodity. Acid-grade fluorspar, containing 97% or more CaF_2, accounted for about three-fourths of the total production in 1978 and the proportion increased in 1979. Approximately 88% of total fluorspar resources were concentrated primarily in the Transvaal, Zululand, and northwestern Cape Province. In 1978 recoverable reserves were estimated at 190 million tons of ore with an average grade of 25% CaF_2, which can be readily improved by flotation.

The largest producer of fluorspar was Marico Fluorspar (Pty.) Ltd., a subsidiary of U.S. Steel Corp. Marico produced 120,000 tons per year of acid-grade fluorspar and 50,000 tons per year of metallurgical-grade fluorspar at its operation in Zeerust, Transvaal. Buffalo Fluorspar (Pty.) Ltd., a General Mining subsidiary, was rated as the world's largest producer of acid-grade fluorspar at its mine near Naboomspruit, which had a production capacity of 150,000 tons per year. Other producers were Chemspar Ltd., a subsidiary of Phelps Dodge, Vergenoeg Mining (Pty.) Ltd., owned by Bayer AG, and Ruigtepoort Fluorspar Mines (Pty.) Ltd.

Gypsum.—Production of gypsum declined from 1977 levels as both local sales and exports decreased. Domestic gypsum consumption declined owing to a slump in the building industry. Gypsum occurred extensively in western and northwestern Cape Province, in the Kimberley district of Orange Free State, and in central Transvaal Province. Reserves were estimated at 85 million tons. The largest producer was Gypsum Industries Ltd. with an annual production capacity of 620,000 tons per year from three mines.

Phosphate.—The government-controlled Phosphate Development Corp. Ltd. (FOSKOR) accounted for most of the Republic's phosphate production from its Palabora carbonatite deposit in northeastern Transvaal. Until 1979 FOSKOR's production of concentrates containing more than 30% P_2O_5 came from three sources: (1) Its own 8% to 9% P_2O_5 ore from its portion of the carbonatite deposit it owned and mined jointly with PMC, which owned the rights to copper, base metals, precious metals, and vermiculite, but not phosphate; (2) Copper-poor overburden stripped by PMC in order to expose its copper ore; and (3) The coarse fraction of PMC's tailings, which contained apatite and other phosphate minerals ready for FOSKOR's treatment. Concurrently with PMC's major open pit expansion plan, FOSKOR has also expanded its plant capacity to 3 million tons per year and agreed to draw exclusively on PMC's piped tailings and stockpiled overburden for its future ore requirements. FOSKOR continued to sell most of its concentrate locally to Federale Kunsmis Ltd. (FEDMIS) and Triomf Fertilizer (Pty.) Ltd., both of which manufactured phosphoric acid for export. Both the 250,000-ton-per-year plant operated by FEDMIS at Palabora, and the 500,000-ton-per-year Triomf plant at Richards Bay, were producing below capacity.

Another producer of phosphate was GFSA's Glenover Phosphate Ltd. with total output of about 75,000 tons of selective mine-run and hand-cobbed ore. Reserves at Glenover's mine in Thabazinbi, Transvaal, were estimated at 10 million tons of ore with an average content of 20% to 30% P_2O_5. Ore was sold locally to Chemfos Ltd., a subsidiary of SAMANCOR. A feasibility study was being conducted on mining vermiculite as a coproduct of phosphate at Thabazimbi. SAMANCOR suspended operations at its Langebaan Phosphate works in Cape Province early in 1978 owing to escalating costs and product surpluses in its traditional marketing area. Production capacity was 250,000 tons per year of concentrate sold primarily to the local market.

Vermiculite.—Vermiculite was produced as a byproduct from the copper operations of Palabora Mining Co. in northeastern Transvaal. The Republic of South Africa was the world's second-largest producer of this commodity and accounted for about one-third of world production. Both production and sales value increased in 1978 but declined in 1979. The bulk of production was exported chiefly to the United States and Western European countries with only about 7,000 tons per year consumed locally. Palabora had an annual production capacity of about 210,000 tons per year of vermiculite from its open pit operation. Reserves were estimated at 75 million tons.

MINERAL FUELS

Coal.—Coal was the nation's second-largest mineral revenue earner after gold in 1978 and 1979, when total value increased to a new record high of nearly $1.4 billion owing to increased prices for both exports and local sales. In 1978, coal supplied approximately 70% of the country's energy needs, and total production and exports continued to expand through 1979. Coal consumption was as follows: power generation was 57%; coke production dropped from 12% in 1978 to 11% in 1979; and industry was steady during both years at 10%, as were the SASOL oil-from-coal project at 7%, and mines and local merchants at 14%. The SASOL II oil-from-coal plant consumed 1% in 1979 as certain units commenced functioning.

The Republic expected to increase coal exports to 44 million tons per year by 1985 and to expand the capacity of the Richard's Bay facility accordingly. Coal production was rapidly expanding as new mines were opened or developed, and several operating mines were undergoing expansion in 1978 and 1979. It was estimated that development expenditures totaling $1.15 billion were initiated during those years. AAC's Amcoal subsidiary commissioned the Kleinkopje colliery, located near Witbank in Transvaal Province. Kleinkopje was to eventually supply 4.7 million tons per year of coal to the local commercial market and ISCOR, as well as export markets. Amcoal's new Kriel colliery, commissioned in 1977 had a production rate of 4.5 million tons per year by mid-1979. Trans-Natal Coal Corp. Ltd., a subsidiary of General Mining and Finance Corp., started production from the Ermelo mine, which was to eventually produce 3 million tons per year of steam coal for export. Shell Coal of South Africa Ltd., in conjunction with Transvaal Consolidated Land and Exploration Co. Ltd., commissioned Rietspruit, the country's largest export colliery on March 29, 1979. Located near Witbank, Rietspruit was designed to produce 5 million tons per year of steam coal for export. The Electricity Supply Commission (ESCOM) started production at its Matla No. 1 mine in May 1978 and began stockpiling coal at the rate of 2.2 million tons per year to supply the future Matla power station. Matla No. 2 mine was to come onstream in 1981 at a capacity of 4.2 million tons per year.

Petroleum.—The Republic of South Africa imported all its crude oil requirements other than the production obtained from the SASOL I oil-from-coal plant. In 1978, imports were approximately 125 million barrels of petroleum from Iran and the Arabian Gulf states. The country's five refineries had a throughput capacity of approximately 350,000 barrels per day. Information about oil imports and refinery throughput became increasingly difficult to obtain during 1979.

Petroleum exploration continued both onshore and offshore under the direction of the Government-owned Southern Oil Exploration Corp. (Pty.) Ltd. (SOEKOR). Since 1960, SOEKOR has spent $150 million on oil prospecting with disappointing results. It was announced in 1978 that exploration onshore would cease in 1979 since it has yielded only small, uneconomic occurrences of oil and gas, particularly associated with coal in northern Natal and the southeastern Transvaal. In 1978, SOEKOR reported oil traces in the Bredasdorp Basin south of Mossel Bay and small gas occurrences in Pletmos Basin. Exploration and drilling continued offshore along the west and south coasts in 1979.

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[1] Physical Scientist, Branch of Foreign Data.

[2] Regional Resources Officer, U.S. Consulate General, Johannesburg, Republic of South Africa.

[3] Where necessary, values have been converted from South African Rand (R) to U.S. dollars at the rate of R1 = US$1.15 for 1978 and at R1 = US$1.19 for 1979.

[4] U.S. Consulate General, Johannesburg, Republic of South Africa. Department of State Airgram A-47, July 15, 1980, Industrial Outlook Report: Minerals; South Africa - 1979, p. 38.

[5] Page 62 of the reference cited in footnote 4.

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The Mineral Industry of the Territory of South-West Africa

By Miller W. Ellis[1] and Candice Stevens[2]

The mineral industry contributed approximately 50% of the value of the estimated $1.3 to $1.4 billion[3] gross domestic product (GDP) of the Territory of South-West Africa in 1978 and 1979. Although some base-metal mines were closed owing to low metal prices, diamond prices rose 30% by yearend 1978 and 13% by September 1979, and uranium production increased in both years. Two firms, Consolidated Diamond Mines of South-West Africa (Pty.) Ltd. (CDM) and Rossing Uranium Ltd., accounted for over 75% of the value of mineral output. Other important mineral exports were copper and lead, produced primarily by Tsumeb Corporation Ltd. The Territory's operating budget of appoximately $500 million was derived largely from tax revenue paid by the mineral industry.

Labor problems caused slowdowns at several mines. The Rossing uranium mine, Krantzberg tungsten mine, and Uis tin mine experienced strikes in 1978 and negotiations over pay rates at Tsumeb were settled by wage increases in January and May 1979. In 1978, a Chamber of Mines, established to replace the former Mining Association, was composed of representatives of the mining companies in the Territory. Its functions were to promote and protect the interests of the industry, attend to matters such as transport and labor, and monitor marketing exports. A Government commission was also established to investigate the feasibility of subsidies for marginal mines during periods of low prices.

In August 1978, areas previously closed in the northern part of the Territory were opened to mineral exploration. CDM initiated a detailed geological, geochemical, and airborne geophysical survey for minerals other than diamonds in the northern and eastern parts of the country. The first results of this survey, which covered Kaokoveld, Ovamboland, and the Gobabis area, were placed on open file with the Geological Survey of South-West Africa. CDM appropriated $28 million for diversification outside the diamond area. Mineral exploration for uranium and base metals was undertaken by Johannesburg Consolidated Investment Co. (JCI), Falconbridge Nickel Mines Ltd., Anglo Transvaal Consolidated Investment Co. Ltd., and Barlow Rand Ltd.

A consortium of British and South African engineering companies were studying the feasibility of constructing a Trans-Kalahari Railroad at an estimated cost of $1 billion. The 900-kilometer railroad would link Francistown in northern Botswana with the existing railhead at Gobabis in South-West Africa. Various Governments and organizations such as the United Nations have been approached with a preliminary report, and tenders have been requested. The Ruacana Falls hydroelectric scheme, which was to supply electricity to the northern half of the Territory, remained incomplete because South African engineers were denied access to the north bank of the river by Angolan authorities. The Territory was to be linked with the Electricity Supply Commission of South Africa (ESCOM) grid through a 320-megawatt power line. The status of the port of Walvis Bay, which handled over 80% of the Territory's exports, remained a subject for negotiations between the Territory and the Republic of South Africa, which has held ownership rights to the port since 1884.

PRODUCTION AND TRADE

Since the compilation of separate production and trade statistics for the Territory was suspended by the South-West Africa Administration in 1965, much of the statistical data in table 1 was derived from the annual reports of the companies operating in the Territory. Although virtually all of the Territory's mineral products were exported, specific data on exports remained unavailable and are no longer incorporated with exports reported by the Republic of South Africa. Trade statistics on some imports have been incorporated with those of the Republic of South Africa with which the Territory is a member in the South African Customs Union.

The Territory's balance-of-trade surplus was estimated at $350 million in 1978 increasing to about $450 million in 1979 chiefly owing to increased earnings from uranium and diamond exports. The mining sector's share of total export earnings increased from 68% to nearly 75% in 1979. Diamond was marketed by the Central Selling Organization of DeBeers Consolidated Mines Ltd. Uranium was sold under contract to Japan and Western European countries. Metal production from Tsumeb Corp. was transported on a 640-kilometer company-owned railroad to Tsumeb's loading facilities at Walvis Bay for overseas refining.

COMMODITY REVIEW

METALS

Copper.—The gross value of total sales of Tsumeb Corp., the Territory's principal producer of nonferrous metals, increased from $61 million in 1977 to $86.4 million in 1978 and more than $131 million in 1979 owing largely to increased copper sales and higher metal prices. The company's profits increased from $2.5 million to $12 million and to $26 million for the same periods. Tsumeb was South-West Africa's leading producer of copper, lead, and silver; a secondary producer of zinc; and the only source of arsenic and cadmium. Newmont Mining Corp. (United States) was the manager and a principal shareholder (29.2%) of Tsumeb Corp., whose other owners included AMAX Inc. (29.9%), Selection Trust Ltd. (14.2%), O'okiep Copper Co. Ltd. (9.5%), Union Corporation Ltd. (9.4%), South-West Africa Co., Ltd. (SWACO) (2.4%), and others (6.1%).

At Tsumeb, the company's largest mine located 400 kilometers north of Windhoek, 466,533 tons of ore were milled in 1978 containing 4.95% copper, 7.01% lead, and 1.68% zinc. Mine development, which had been at a reduced rate since 1976 pending improved metal prices, was accelerated somewhat but the grade declined during 1979. Tsumeb's ore reserves at yearend 1979 were estimated at 3.5 million tons containing 4.27% copper, 7.02% lead, and 1.91% zinc.

Tsumeb's Matchless mine plant, located 42 kilometers south of Windhoek, milled 110,000 tons of high-sulfur copper ore in 1978 and 115,000 tons in 1979. Reserves at yearend were estimated at 702,161 tons of ore containing 2.34% copper and 12.56% sulfur. The Kombat mill, reopened in October 1978, treated 40,510 tons of ore containing 2.23% copper and 1.66% lead from both the Kombat and Asis West deposits by yearend. The Kombat feed increased to 301,420 tons of ore with 2.89% copper and 2.31% lead in 1979. The mill feed from Asis West amounted to 17,174 tons with 3.06% copper and 0.72% lead. The nearby Asis Ost mine remained idle during the 2-year period. Reserves at yearend 1979 were:

Deposit	Metric tons	Copper (percent)	Lead (percent)
Kombat	564,700	1.65	2.97
Asis West	568,045	5.57	2.86
Asis Ost	255,386	2.83	0.67

Tsumeb Corp.'s overall copper production increased from 22,827 tons in 1977 to 29,633 tons in 1978 and decreased to 28,768 tons in 1979. Sales totaled 32,522 tons in 1978 rising to 32,707 tons in 1979 as secondary stocks at the smelter were reduced to minimum operating levels. The No. 2 smelter circuit, constructed to treat toll concentrates from the Otjihase mine, was idle throughout both 1978 and 1979 and Tsumeb received penalty

Table 1.—Territory of South-West Africa: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS[2]				
Arsenic, white[3]	[r]5,122	2,615	2,401	2,250
Cadmium:				
Mine output, metal content, recoverable	118	88	79	80
Metal, refined	83	80	70	70
Copper:				
Mine output, metal content, recoverable[4]	[r]43,500	49,200	37,700	41,000
Metal, blister	36,100	53,400	45,900	42,200
Lead:				
Mine output, metal content, recoverable	46,400	41,200	38,600	46,000
Metal, refined	39,600	42,700	39,500	40,000
Silver:				
Mine output, metal content, recoverable[5] thousand troy ounces	1,400	1,684	1,399	1,606
Metal, smelter, Ag content of blister copper	[e]1,250	1,200	[e]1,100	1,100
Tin, mine output, metal content, recoverable	800	994	1,250	1,000
Tungsten, mine output, metal content, recoverable[6]	140	150	150	165
Uranium, U_3O_8 content	700	2,760	3,175	4,000
Vanadium, mine output, metal content[6]	700	750	440	--
Zinc, mine output, metal content[6]	41,308	38,300	36,600	54,000
NONMETALS				
Diamond:[7]				
Gem thousand carats	1,609	1,901	1,803	1,850
Industrial do.	85	100	95	100
Total do.	1,694	2,001	1,898	1,950
Lithium minerals[8]	5,915	2,548	NA	2,700
Pyrite concentrates, gross weight	9,200	9,000	NA	9,000
Salt[e]	220,000	230,000	230,000	230,000
Sulfur, S content of pyrite	4,000	4,000	4,000	4,000

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, the Territory of South-West Africa, prior to 1967, produced bismuth concentrates, cesium ore, columbite-tantalite concentrates, gold, manganese ore, molybdenum concentrates, graphite, kyanite, lime, mica, precious stones, sillimanite, and a variety of crude construction materials (clays, stone, and sand and gravel). No official statistics have been published since yearend 1966, and available information is inadequate to ascertain if production has continued and, if so, at what levels.

[2] Data for 1976, 1977, and 1978 are compiled from operating company reports for 1976-78 as follows: Tsumeb Corp. Ltd. (arsenic, mine and refined cadmium, mine and blister copper, mine and refined lead, mine and smelter silver, mine zinc, and pyrite concentrates); South-West Africa Co. Ltd. (SWACO) (mine lead, mine tin, mine tungsten, mine vanadium, and mine zinc); South African Iron and Steel Industrial Corp. Ltd. (ISCOR) for Imcor Zinc (Pty.) Ltd.'s Rosh Pinah mine (mine lead and mine zinc) and for ISCOR's own Uis mine (mine tin); General Mining & Finance Corp. Ltd. for Klein Aub Koper Maatskappy Ltd.'s mine near Rehoboth (mine copper and mine silver); and Falconbridge Nickel Mines Ltd. for Oamites Mining Co. (Pty.) Ltd.'s Oamites mine (mine copper). Data from Tsumeb and Falconbridge are for calendar years; data from other companies are for fiscal years ending June 30 of that stated.

[3] White arsenic equivalent of all arsenic products reported as being produced.

[4] Figures for 1976, 1977, and 1978 comprise reported production of Tsumeb and Oamites plus estimates for Klein Aub and Johannesburg Consolidated Investment Co. Ltd.'s Otjihase copper mine.

[5] Figures for 1976, 1977, and 1978 comprise reported production of Tsumeb plus estimates for Oamites and Klein Aub.

[6] Figures for 1976, 1977, and 1978 comprise reported production of ISCOR for Imcor's Rosh Pinah mine plus an estimate for Tsumeb (based on ore milled), as well as an estimate for SWACO for 1977 and 1978.

[7] Totals reported by De Beers Consolidated Mines Ltd. in company annual reports for calendar years; detail on gem and industrial diamond are estimates, assuming output to be 95% gem quality.

[8] Output has not been officially reported since 1966 but presumably has continued, since a number of countries record imports from "South Africa," which in total quantity considerably exceed reported output of the Republic of South Africa and presumably include shipments from the Territory of South-West Africa. Quantities given represent imports of the United States and the European Communities reported as originating in South Africa, but the reader is cautioned that a portion of the material may have been mined in Southern Rhodesia.

payments for nondelivery of concentrates. At the beginning of 1978, Tsumeb Corp. established a London sales office and commenced marketing its own products jointly with O'okiep Copper Co. Ltd. of Springbok in the Republic of South Africa.

The Territory's second largest producer of copper was Oamites Mining Co. (Pty.) Ltd., a joint venture of Falconbridge Nickel Mines Ltd. (Canada) (74.9%) and International Development Corp. (IDC) of the Republic of South Africa (25.1%). The Oamites mine, located 55 kilometers south of Windhoek, produced and milled successively 620,000 tons, 615,000 tons, and 575,000 tons of ore from 1977 through 1979. Recoverable copper output decreased 6,916 tons in 1978 to 6,231 tons in 1979 but the sales revenue increased from $13.38 million to $18.5 million during the same period. Reserves at yearend 1979 were estimated at over 2 million tons of ore containing 1.09% copper and about 0.5 troy ounce of silver per ton.

Klein Aub Koper Maatskappy Ltd., a subsidiary of General Mining and Finance Corp. Ltd. (GMF) (Republic of South Africa) produced copper/silver concentrates for its mine and mill near Rehoboth, shipped them to Tsumeb for smelting, and exported the blister to Federal Republic of Germany at a rate of nearly 5,000 tons per year. Higher prices for metals, particularly silver, accounted for the company's first dividend in several years of $0.9 million in 1978 and for a fivefold increase in dividend to $5.1 million in 1979. The Otjihase copper mine, located 27 kilometers northeast of Windhoek and owned by Johannesburg Consolidated Investment Co. Ltd. (JCI) (49%) and Minerts Development (Pty.) Ltd. (51%), remained on a care-and-maintenance basis throughout 1978 and 1979. The Otjihase plant was being maintained in such condition that production could again be resumed at short notice. Previous output consisted of concentrate shipped to Tsumeb and smelted into approximately 6,000 tons per year of blister copper.

Lead, Zinc, and Vanadium.—Tsumeb was the Territory's leading producer of lead with 33,826 tons in 1978, decreasing to 31,369 tons in 1979. Sales were 39,974 tons and 33,505 tons for 1978 and 1979, respectively. Tsumeb also produced nearly 500 tons of zinc concentrate, and byproduct arsenic and cadmium, and about 1.5 million troy ounces per year of silver. A secondary producer of lead and a major producer of zinc was the Rosh Pinah mine, located in the Namib Desert about 27 kilometers north of the Orange River. The open-pit mine had a capacity of 160,000 tons of ore per month to produce about 40,000 tons of 48% zinc concentrate and 12,000 tons of 45% lead concentrate per year. Rosh Pinah was operated by Imcor Zinc (Pty.) Ltd., a subsidiary of the South African Iron and Steel Industrial Corporation Ltd. (ISCOR).

The Berg Aukas mine, which has produced lead, zinc, and vanadium concentrates since the early 1920's, was closed because of low metal prices. Located near Grootfontein, Berg Aukas was acquired for SWACO by Kiln Products Ltd., administered by Gold Fields of South Africa Ltd. (GFSA), and partly owned (41.85%) by Anglo American Corp. of South Africa Ltd. (AAC). Kiln Products operated a kiln on the Berg Aukas property in which zinc silicate concentrate and zinc residues, bought from Berg Aukas, were roasted and converted to oxides. The zinc oxide was then sold to GFSA's subsidiary refinery, Zinc Corp. of South Africa Ltd. (ZINCOR).

Tin and Tungsten.—The Uis tin mine, located northeast of Swakopmund near Brandberg, was the Territory's major tin producer with output averaging 800 tons per year of tin metal. This massive low-grade tin deposit containing about 0.15% tin was operated by Industrial Minerals Corp. (Pty.) Ltd., a wholly-owned subsidiary of ISCOR. Mill throughput capacity was around 72,000 tons of ore per month to produce some 1,300 tons of concentrate per year containing about 64% tin. Output from the Uis mine was shipped to ISCOR's tin smelting plant in the Vanderbijlpark Steel Works in the Republic of South Africa.

SWACO brought its Brandberg West tin-tungsten mine back into production in 1975 after a hiatus of 3 years. Production averaged 200 tons of tin and 150 tons of tungsten per year and the mine operated at less than full capacity in 1978-1979. In October 1979, the Strathmore tin mine recommenced production with a staff of 50 people. Tungsten was produced by the Krantzberg mine, owned by Nord Resources Corp. (40%) and Ebco Mining Co. (60%). Located near Omaruru, northwest of Windhoek, Krantzberg's production capacity was rated at 600 tons of 70% tungsten trioxide concentrate per year but the mine has operated at less than capacity in recent years. Tungsten reserves in South-West Africa were estimated at 4,000 tons of contained tungsten metal.

Uranium.—Output from Rossing's large uranium operation near Swakopmund increased rapidly from startup in 1977 to planned output capacity by yearend 1979. Gross turnover value increased from $156 million in 1958 to $272 million in 1979, while net profits increased from $2.8 million to $26.7 million during the same period. Since the first uranium output in mid-1976, Rossing has suffered a series of design and technical difficulties in the treatment plant. Throughput was restricted by the abrasiveness of the ore which caused excessive wear in the plant. Modifications to the grinding circuit cost $100 million but have increased milling capacity to about 40,000 tons per day of ore. In May 1978, a fire in one of the treatment plant's two solvent extraction units necessitated extensive repairs and replacements. A workers' strike over wage levels at yearend 1978 caused reduced output until it was settled in 1979. The large (375 million tons) low-grade (0.4% U_3O_8) ore body was managed and partly owned by the

Rio Tinto Zinc Corp. Ltd. (United Kingdom) (46.5%) and has been worked to a depth of 60 meters over an area of about 2.5 square kilometers. It was designed for an overall size of 3 square kilometers to a depth of 300 meters with possible subsequent underground development. The other partners include IDC, GMF (South Africa), and Total Compagnie Miniere et Nucleaire (France). Contracts for the delivery of uranium oxide production through the mid-1980's were concluded during the year. Major purchasers were the United Kingdom Atomic Energy Commission, Kansai Electric Power Company of Japan, Total (France), and Urangesellschaft (West Germany).

Uranium prospecting was being conducted north and east of Swakopmund by a number of other companies. General Mining was considering a $350 million operation at the 60-million-ton Langer Heinrich uranium deposit near Tinkas. Production was estimated at 3,000 tons per year of U_3O_8, and pilot plant work needed to develop a viable alkali leach process for the secondary calcrete ore was completed during 1978. GFSA evaluated the Trekkopje uranium deposit 20 kilometers northeast of Rossing, and AAC reported substantial tonnages of uranium mineralization in its concession area. Other groups conducting uranium exploration included Falconbridge and Omitaramines (France).

NONMETALS

Cement.—The First National Development Corporation, a consortium of several South-West African firms, was to contribute $7 million toward the construction of a $35 million cement plant in Karibib northwest of Windhoek. Feasibility studies were in progress on the plant which would be the first in South-West Africa. The major investor in the plant was the South-West Africa Portland Cement Co. Ltd., owned by Pretoria Portland Cement Co. and Anglo-Alpha Cement Co., both of the Republic of South Africa. The plant was to utilize local limestone and gypsum deposits, and to begin production in 1981.

Diamond.—Diamond production by CDM, a wholly owned subsidiary of DeBeers Consolidated Mines Ltd., decreased slightly below the 1977 level in 1978 and 1979. Approximately 95% of CDM's diamonds were gemstones and CDM accounted for 22% of DeBeers' after-tax profits in 1978. The amount of gravel treated at Oranjemund increased from 14.90 million tons in 1977 to 15.14 million tons in 1978 and 16.03 million tons in 1979 but the recovery grade dropped from 0.1343 carat per ton to 0.1031 carat per ton over the 2-year period. The quantity of overburden stripped at CDM's mining operation, stretched over 100 kilometers of coastal area north of the Orange River, decreased from 59 million tons in 1977 to 55 million tons in 1978 and 54.9 million tons in 1979. Modifications and improvements effected during the year to the four conglomerate treatment plants, all of which were operating at full capacity, enabled more efficient operations to be achieved. However, a fire and the failure of a bridge bearing at the bucketwheel excavator caused its availability to drop to 65% by 1979. A special effort was undertaken to establish new reserves which might extend the life of CDM's diamond operation in South-West Africa. Reconnaissance prospecting was conducted over large portions of the country. Exploration on both the beach and inland in the Sperrgebiet area below Luderitz was intensified. Work continued on the sampling of potential reserves in the central and western blocks of the diamond mining area in order to increase ore reserve information. Modifications to the sampling plant were completed in 1979 and 720,400 tons of samples were treated, 52% more than in 1978. Systematic sampling at sea was also conducted.

MINERAL FUELS

Coal.—Evaluation of South-West Africa's low-grade coal deposits continued in 1978 and 1979. Drilling was being conducted in three general areas: northeast of Etosha Pan in Ovamboland; along the Kaokoveld coast; and northeast of Aminuis along the Botswana border.

Petroleum.—All oil exploration in the Territory was under the direction of the Southern Oil Exploration Corp. (Pty.) Ltd. (SOEKOR) of the Republic of South Africa. No prospecting activity other than offshore drilling conducted by SOEKOR was reported. South-West Africa imported all of its petroleum product requirements.

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[1] Physical scientist, Branch of Foreign Data.

[2] Economist, Branch of Foreign Data.

[3] Where necessary, values have been converted from South African Rand (R) to U.S. dollars at the rate of R1 = U.S.$1.153 for 1978 and R1 = US$1.189 for 1979.

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The Mineral Industry of Spain

By Roman V. Sondermayer[1]

During 1978 and 1979, Spain continued to develop its mineral resources with the aim of lowering imports of raw materials and fuels and improving its trade deficit in minerals. Spain's approximate share of world output of its most significant minerals was as follows: mercury 18%, pyrite 11%, fluorspar 8.5%, potash 2.1%, steel 1.6%, zinc 1.5%, and barite 1.4%. The share of the mineral industry in the gross national product (GNP) of the country was declining as sharp increases in other sectors of the economy lowered the importance of the mining sector to below 1% of the GNP. Spain was dependent on imports for most of its petroleum, coking coal, and metals.

During 1978, the Government issued Royal Decree 1167, which expands upon provisions in Mining Development Law 6 for promoting and developing mining, prospecting, and research within the national territory. In short, producers of raw materials assigned priority under the country's national supply plan receive a rebate of up to 95% of taxes on property transfers, imports, capital gains, and other commercial and industrial activities and profits during the installation period. Furthermore, during 1979, work on the Spanish National Raw Materials Plan was completed. The plan known in Spain as Plan Nacional de Abastecimiento de Materias Primas Minerales (PNAMPM) will require the investment of 247,267 million pesetas. The State will provide 40% of planned investment and private capital the rest. The prime goal of the plan is to reduce foreign dependence on imports of mineral raw materials. Five minerals (iron, manganese, copper, zinc, and lead) will receive priority, and these minerals will account for 60% of total planned investments.

In 1978, major events of the mineral industry were the completion of an aluminum plant at San Ciprián, expansion of copper mines at Cerro Colorado, development of complex sulfide ore deposits at Aznalcollar and Sotiel, discovery of natural gas in areas in the north and south of Spain, and discovery of uranium in the provinces of Salamanca and Segovia. In 1979, major events were as follows: completion of construction of a steel miniplant near La Coruña and commissioning of the complex sulfide ore mine and plant at Aznalcollar.

PRODUCTION

Ownership of the mineral industry was both Governmental and private. The Government manages most of its companies through Instituto National de Industria (INI).

Table 1 shows changes in output of minerals during 1978 and 1979.

Table 1.—Spain: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Bauxite	13,500	4,754	[e]5,000	10,000
Metal:				
Primary	210,516	211,167	212,100	[1]259,511
Secondary	40,000	40,000	[e]38,500	39,000
Antimony, mine output, metal content	[r]260	493	471	490
Arsenic, white[e]	10	10	10	--
Cadmium metal	246	303	253	230
Copper:				
Mine output, metal content	35,555	48,300	42,200	45,000
Metal:				
Blister	141,276	145,446	145,446	136,500
Refined:				
Primary:				
Thermal	[r]110,000	130,000	117,000	NA
Electrolytic	[r]31,900	29,000	30,000	NA
Total	[r]141,900	159,000	147,000	[1]144,364
Secondary	[r]31,000	29,000	[e]30,000	30,000
Gold, mine output, metal content ... troy ounces	148,601	150,144	[e]150,000	155,000
Iron and steel:				
Iron ore and concentrate, gross weight ... thousand tons	[e]8,227	8,327	8,394	9,220
Metal:				
Pig iron ... do	6,624	6,605	6,253	[1]6,388
Electric-furnace ferroalloys ... do	299	301	365	366
Steel:				
Crude ... do	10,910	10,921	11,345	12,290
Castings and forgings ... do	[r]92	181	300	40
Total ... do	[r]11,002	11,102	11,645	12,330
Semimanufactures ... do	12,017	12,164	10,801	NA
Lead:				
Mine output, metal content	62,196	61,006	72,400	72,400
Metal:				
Primary	75,516	89,177	82,850	90,000
Secondary	3,020	NA	NA	NA
Mercury:				
Mine output, metal content ... 76-pound flasks	42,729	35,013	31,039	35,000
Metal ... do	40,147	21,532	48,037	48,037
Silver:				
Mine output, metal content ... thousand troy ounces	3,222	3,215	3,092	3,000
Metal, primary ... do	3,107	NA	NA	NA
Tin:				
Mine output, metal content	390	554	520	500
Metal, primary	5,369	5,343	[e]4,143	5000
Titanium dioxide	21,110	39,478	39,336	40,000
Tungsten, mine output, metal content	[r]329	341	273	318
Uranium, mine output, U_3O_8 content	228	243	272	[1]336
Zinc:				
Mine output, metal content	83,370	96,231	143,512	136,300
Metal:				
Primary	158,364	156,628	163,258	173,000
Secondary	NA	NA	4	NA
NONMETALS				
Barite	[e]92,695	83,284	[e]80,000	90,000
Bromine[e]	408	408	408	408
Cement, hydraulic, other than natural ... thousand tons	25,202	27,996	30,233	[1]27,912
Chalk ... cubic meters	115,808	179,936	[e]180,000	185,000
Clays:				
Bentonite	108,148	102,300	[e]100,000	110,000
Kaolin, marketable:				
Crude	[e]140,000	113,125	[e]120,000	115,000
Washed	207,180	232,145	[e]220,000	230,000
Other ... thousand cubic meters	8,517	9,165	NA	NA
Diatomite and tripoli	[e]17,150	28,281	[e]28,000	18,000
Earths, industrial, n.e.s	23,046	35,812	NA	NA
Feldspar and pegmatite	90,964	93,222	[e]90,000	90,000
Fluorspar:				
Gross weight:				
Acid grade[2]	221,977	211,825	198,535	210,000
Metallurgical grade	64,676	98,636	199,000	200,000
Total	[r]286,653	310,461	397,535	410,000

See footnotes at end of table.

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Table 1.—Spain: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^{p}	1979^{e}
NONMETALS —Continued				
Fluorspar —Continued				
CaF_2 content:				
Acid grade^{3}	215,766	209,837	193,535	200,000
Metallurgical grade	69,887	130,000	178,530	195,000
Total	285,653	339,837	372,065	395,000
Gypsum and anhydrite, crude thousand tons	^{e}4,200	5,482	^{e}5,500	45,000
Kyanite and related materials and andalusite^{e}	5,743	6,600	6,000	6,000
Lime, hydrated and quicklime^{e} thousand tons	400	400	350	400
Magnesite, crude	^{e}348,082	421,241	^{e}400,000	450,000
Meerschaum (sepiolite)	^{e}66,496	97,630	NA	NA
Mica	^{e}500	--	--	--
Nitrogen, N content of ammonia thousand tons	^{r}1,051	965	880	820
Pigments, mineral:				
Ocher	8,983	12,365	^{e}12,400	12,000
Red iron oxide	27,151	36,261	^{e}24,000	25,000
Potash salts, K_2O equivalent	630,252	561,630	^{e}558,000	590,000
Pumice	120,839	331,798	900,000	910,000
Pyrite, including cuprous, gross weight thousand tons	2,349	2,404	2,340	^{1}2,366
Salt:				
Rock do.	^{r}1,200	1,233	1,300	1,300
Marine and other do.	1,159	1,201	^{e}1,200	1,360
Sand and gravel: Silica sand do.	^{r}1,622	^{3}2,698	NA	NA
Sodium compounds:				
Sodium carbonate, manufactured do.	^{r}524	$^{r\,e}$320	499	500
Sodium sulfate:				
Natural:				
Glauberite, Na_2SO_4 content	55,390	73,705	^{e}80,000	90,000
Thenardite, Na_2SO_4 content	108,938	107,411	^{e}110,000	120,000
Manufactured	166,380	^{1}74,307	121,704	175,000
Stone:				
Calcareous:				
Dolomite thousand cubic meters	1,120	1,076	NA	NA
Limestone do.	41,219	44,732	NA	NA
Marble do.	289	311	NA	NA
Marl do.	30,062	2,863	NA	NA
Basalt do.	2,763	782	NA	NA
Granite do.	2,717	2,683	NA	NA
Ofite do.	426	631	NA	NA
Phonolite do.	148	169	NA	NA
Porphyry do.	126	105	NA	NA
Quartz thousand tons	^{e}598	NA	NA	NA
Quartzite thousand cubic meters	249	205	NA	NA
Sandstone do.	634	1,008	NA	NA
Slate do.	599	619	NA	NA
Trass and tufa do.	241	NA	NA	NA
Other do.	16,481	NA	NA	NA
Strontium minerals	^{e}7,500	^{e}7,500	7,300	7,300
Sulfur:				
S content of pyrite	1,052	1,102	1,071	1,160
Byproduct:				
Of metallurgy	^{r}123	129	117	120
Of petroleum	^{r}4	5	10	10
Of coal (lignite) gasification	^{r}1	2	3	3
Talc and steatite	47,617	^{e}50,000	^{e}55,000	50,000
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	^{e}12,065	NA	NA	NA
Carbon black	50,336	52,745	^{e}53,000	53,000
Coal:				
Anthracite thousand tons	3,548	3,663	3,736	^{1}3,696
Bituminous do.	6,969	8,042	7,668	^{1}7,794
Lignite do.	4,150	5,788	8,250	^{1}10,548
Total do.	14,667	17,493	19,654	^{1}22,038
Coke, metallurgical do.	^{r}4,356	4,276	3,886	^{1}3,897
Fuel briquets:				
Briquets do.	10	7	7	6
Ovoids do.	84	69	43	40
Gas, natural, marketed million cubic feet	41	^{e}40	40	NA
Peat	30,552	41,721	^{e}42,000	40,000
Petroleum:				
Crude thousand 42-gallon barrels	11,552	6,898	5,926	6,000

See footnotes at end of table.

Table 1.—Spain: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products:				
Gasoline, motor thousand 42-gallon barrels	44,288	44,750	46,719	[1]46,844
Jet fuel do	17,489	16,282	19,056	[1]17,908
Kerosine do	1,284	2,264	893	[1]473
Distillate fuel oil do	77,221	96,434	78,136	[1]83,272
Residual fuel oil do	163,758	137,246	138,875	[1]139,663
Lubricants, including grease do	1,677	1,791	1,706	[1]1,657
Other do	48,388	39,170	44,280	44,000
Refinery fuel and losses do	22,032	16,896	20,848	21,000
Total do	376,137	354,833	350,521	354,817

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1]Reported figure.

[2]Includes recorded production of salable acid-grade fluorspar from both fluorspar mines and lead-zinc mines plus some salable acid-grade fluorspar obtained by beneficiating a portion of salable metallurgical-grade fluorspar.

[3]Includes sand obtained from kaolin.

TRADE

During recent years Spanish imports of minerals have ranged between 30% and 40% of total imports; petroleum has accounted for about 25% of total imports. Exports of minerals were about 15% of the country's total exports. Tables 2 and 3 show details of foreign trade in minerals. The United States had a positive trade balance in minerals with Spain, with a surplus of about $39 million. Coal, coke, and phosphates topped the list by value of U.S. exports to Spain. Zinc metal, quartz, feldspar, fluorspar, mica, salt, and petroleum refinery products were the most valuable imports from Spain.

Table 2.—Spain: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Oxide and hydroxide	52	47	Portugal 19; United Kingdom 13; Argentina 11.
Metal including alloys:			
Scrap	136	219	France 94; West Germany 46; Italy 42.
Unwrought	8,860	5,838	Portugal 2,385; Japan 2,119; Hong Kong 1,001.
Semimanufactures	12,366	10,790	United States 1,886; Portugal 1,268; Cuba 1,037.
Antimony metal including alloys, all forms	262	392	Netherlands 156; United States 90.
Arsenic trioxide, pentoxide, acids	(1)	--	
Bismuth metal including alloys, all forms	6	2	All to Netherlands.
Cadmium metal including alloys, all forms	208	143	United States 79; Netherlands 51.
Chromium:			
Chromite	18	14	All to Italy.
Oxide and hydroxide	16	20	Greece 10; Colombia 6.
Copper:			
Ore and concentrate	2,637	36	All to West Germany.
Matte	575	689	Mainly to West Germany.
Copper sulfate	348	736	Mainly to United States.
Metal including alloys:			
Scrap	1,593	705	West Germany 323; Japan 303.
Unwrought	47,382	52,375	Belgium-Luxembourg 11,140; West Germany 10,453; Italy 9,824; France 9,794.
Semimanufactures	7,770	17,629	Morocco 3,231; Italy 2,505; Portugal 2,146; Iran 1,806.
Gold metal, unworked or partly worked thousand troy ounces	713	482	Switzerland 257; United Kingdom 225.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	1,466	948	West Germany 424; Netherlands 227; United Kingdom 114.
Roasted pyrite do	531	172	Mainly to West Germany.

See footnotes at end of table.

Table 2.—Spain: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Iron and steel —Continued			
Metal:			
Scrap	1,017	727	Belgium-Luxembourg 320; West Germany 206; Colombia 82.
Sponge iron, powder, shot	9,565	11,737	Italy 3,146; France 2,643; West Germany 1,828.
Ferroalloys:			
Ferromanganese	29 444	47,242	West Germany 13,756; United States 12,882; China, Mainland, 8,125.
Other	27,429	74,403	West Germany 27,908; Japan 12,496; United Kingdom 7,987.
Steel, primary forms	35,322	264,871	Thailand 55,017; Hong Kong 51,891; United States 32,689.
Semimanufactures:			
Bars, rods, angles, shapes, sections thousand tons	1,950	2,391	West Germany 239; Morocco 190; France 163.
Universals, plates, sheets	476,857	992,866	United States 352,524; Sweden 91,935; Switzerland 89,400.
Hoop and strip	5,662	17,772	France 4,877; West Germany 4,829; Morocco 2,776.
Rails and accessories	9,668	546	Ecuador 88; Poland 58; France 49; Portugal 45.
Wire	20,782	43,228	Algeria 14,948; Portugal 8,972; France 5,351.
Tubes, pipes, fittings	179,754	406,927	West Germany 84,551; United States 75,919; France 60,546.
Castings and forgings, rough	14,001	22,407	France 4,736; West Germany 2,000; United States 1,846.
Lead:			
Ore and concentrate	83	59	Mainly to France.
Oxides	130	101	Mainly to Brazil.
Metal including alloys:			
Scrap	12	22	All to France.
Unwrought	1,769	5,240	Italy 3,000; United States 1,000; United Kingdom 600.
Semimanufactures	285	227	United States 205.
Manganese:			
Ore and concentrate	123	133	Portugal 68; France 44; Morocco 20.
Oxides	1,708	2,869	France 1,950; Italy 654.
Metal	72	--	
Mercury 76-pound flasks	22,423	42,932	United States 14,707; East Germany 4,902.
Molybdenum metal including alloys, all forms kilograms	1,336	56,482	Mainly to West Germany.
Nickel:			
Matte, speiss, similar materials	22	--	
Metal including alloys:			
Scrap	439	359	France 241; Netherlands 55; West Germany 43.
Unwrought	3	18	United Kingdom 14; Venezuela 4.
Semimanufactures	16	129	Netherlands 63; United Kingdom 19.
Platinum-group metals and silver:			
Waste and sweepings kilograms	80,006	--	
Metals including alloys:			
Platinum-group troy ounces	4,308	578,713	Mainly to West Germany.
Silver thousand troy ounces	47	1,673	France 675; Belgium-Luxembourg 482; Switzerland 354.
Selenium, elemental kilograms	10,000	10,000	Portugal 9,000; Netherlands 1,000.
Tin: Metal including alloys:			
Scrap	121	37	United Arab Emirates 17; West Germany 11.
Unwrought	1,902	331	United Kingdom 71; France 61; Greece 60; West Germany 55; Netherlands 40.
Semimanufactures	14	91	Netherlands 80.
Titanium oxides	7,201	12,476	France 3,071; West Germany 2,027; Italy 1,465; Romania 1,280.
Tungsten:			
Ore and concentrate	467	387	West Germany 204; United Kingdom 81; France 60; Belgium-Luxembourg 41.
Metal including alloys, all forms	27	23	Austria 9; West Germany 6; Algeria 4.
Zinc:			
Ore and concentrate	4,657	7,515	France 5,961; Italy 1,550.
Oxide	823	869	Belgium-Luxembourg 460; Denmark 184; France 130.
Metal including alloys:			
Blue powder	761	602	United States 387; France 215.
Unwrought and semimanufactures	38,081	81,923	United States 65,344.

See footnotes at end of table.

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Table 2.—Spain: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Other:			
Ores and concentrates of molybdenum, tantalum, titanium, vanadium, zirconium	90	56	United States 26; Iran 12; Netherlands 8; Austria 5.
Ash and residue containing nonferrous metals	23,325	33,531	Sweden 15,048; East Germany 12,422.
Oxides, hydroxides, peroxides of metals	14,879	16,352	Kuwait 9,911; Saudi Arabia 5,000.
Metals including alloys:			
Alkali, alkaline-earth, and rare-earth metals	(1)	1	Mainly to Austria.
Pyrophoric alloys	(1)	60	All to Portugal.
Base metals including alloys, all forms, n.e.s.	3	44	Netherlands 33.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	1,990	2,547	United Kingdom 1,000; West Germany 867.
Dust and powder of precious and semiprecious stones value, thousands	$22	$28	Switzerland $10; Argentina $5; Mexico $4; Venezuela $4.
Grinding and polishing wheels and stones	2,358	2,468	West Germany 1,247.
Asbestos	11	33	Italy 20; Portugal 10; Mexico 3.
Barite and witherite	58,070	90,794	West Germany 52,409; Algeria 20,700.
Boron materials:			
Crude natural borates	19	401	Portugal 341.
Oxide and acid	1,120	2,986	United States 1,316; West Germany 900.
Cement thousand tons	7,517	9,830	Saudi Arabia 2,741; Nigeria 1,207.
Chalk	12,919	18,753	Algeria 8,512; Portugal 3,499; Libya 2,308.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	40,090	37,881	Portugal 17,482; West Germany 4,500.
Kaolin (china clay)	57,720	59,802	West Germany 25,853; Italy 9,209; France 7,569.
Other	21,593	24,623	Portugal 5,409; Andorra 4,032; Italy 3,184.
Products:			
Refractory (including nonclay brick)	26,136	32,676	Egypt 6,507; Cuba 5,112.
Nonrefractory	321,084	308,085	France 78,795; West Germany 25,000; Andorra 23,681.
Cryolite and chiolite kilograms	--	50	All to Austria.
Diamond:			
Gem, not set or strung value, thousands	$232	--	
Industrial do	$66	$82	Mexico $33; Ireland $32; Belgium-Luxembourg $12.
Diatomite and other infusorial earth	2,286	1,658	Belgium-Luxembourg 447; Italy 410; United Kingdom 323; France 198.
Feldspar, leucite, nepheline, nepheline syenite	5,720	6,989	Mainly to France
Fertilizer materials:			
Crude and manufactured:			
Nitrogenous	300,316	311,253	Belgium-Luxembourg 68,186; United Kingdom 67,149; Brazil 58,908.
Phosphatic	56,053	17,133	Brazil 10,451; Kenya 3,113; Syria 2,517.
Potassic	492,764	404,741	Portugal 53,232; Norway 52,718; United Kingdom 44,501; United States 40,200.
Other	186,708	191,892	Venezuela 63,500; Turkey 44,928; Thailand 33,941; Sri Lanka 27,500.
Ammonia	38	53	Mauritania 28; Ghana 25.
Fluorspar	200,722	193,485	United States 94,023; West Germany 35,601; Italy 30,491.
Graphite, natural	37	1	Mainly to Peru.
Gypsum and plasters	635,097	775,752	Denmark 194,323; Sweden 188,790; Finland 68,250.
Iodine	1	2	Colombia 1; Venezuela 1.
Lime	7,365	6,999	Kuwait 1,798; Algeria 1,554; Equatorial Guinea 1,541; Morocco 1,000.
Magnesite	92,936	79,029	United Kingdom 25,041; West Germany 21,692; Poland 11,246.
Mica, all forms	950	3,048	United Kingdom 2,704.
Pigments, mineral, including processed iron oxides	10,065	9,652	United Kingdom 1,399; United States 947.
Precious and semiprecious stones, except diamond:			
Natural value, thousands	$61	$141	Switzerland $105; India $13.
Manufactured do	$340	$480	Switzerland $385; United States $36.
Pyrite, gross weight thousand tons	294	242	Belgium-Luxembourg 210.
Salt and brines do	645	816	United States 419; Italy 140; Portugal 75.
Sodium and potassium compounds, n.e.s.	57,501	90,033	China, Mainland, 17,060; Portugal 13,975; Brazil 9,541.

See footnotes at end of table.

Table 2.—Spain: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude or partly worked:			
Calcareous	22,762	26,457	Italy 19,258; France 2,077.
Slate	1,597	1,648	France 1,464.
Other	56.673	79,765	Italy 58,420; France 14,737.
Worked:			
Slate	129,818	147,677	France 125,003; West Germany 10,964.
Paving stone and flagstone	109	48	All to France.
Other	16,247	20,133	West Germany 10,403; France 2,364.
Dolomite	82,374	110,304	United Kingdom 86,974; West Germany 17,750.
Gravel and crushed rock	61,489	58,085	Andorra 41,644; Morocco 15,868.
Limestone	2,000	--	
Quartz and quartzite	195,547	224,408	Mainly to Norway.
Sand, excluding metal bearing	173,366	174,217	Mainly to Andorra.
Sulfur:			
Elemental, all forms	20,615	25,953	Turkey 16,135; Algeria 8,438.
Sulfur dioxide	331	--	
Sulfuric acid	150	112	Morocco 65; France 26; Mauritania 16.
Talc, steatite, soapstone, pyrophyllite	9,608	6,128	Austria 3,000; United Kingdom 1,005.
Other:			
Crude:			
Meerschaum, amber, jet	146,468	--	
Other	365,226	508,142	France 246,684; Belgium-Luxembourg 117,909; West Germany 56,520.
Slag, dross, and similar waste, not metal bearing	43,819	74,367	Portugal 49,446; France 11,363; West Germany 10,407.
Oxides and hydroxides of magnesium, strontium, barium	360	181	West Germany 90; Canada 72; Republic of South Africa 19.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	112,308	82,630	Kuwait 27,960; France 19,285; Nigeria 16,165.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	97	26	Mainly to Abu Dhabi.
Carbon black and gas carbon	3,843	5,081	Portugal 3,921; Algeria 843.
Coal and briquets:			
Anthracite and bituminous coal	21,967	16,395	Mainly to Belgium-Luxembourg.
Lignite and lignite briquets	135	31	All to Andorra.
Coke and semicoke	2,955	2,048	Mainly to Mexico.
Hydrogen, helium, rare gases	190	530	Italy 307; Belgium-Luxembourg 219.
Peat, including peat briquets and litter	(1)	4	All to Portugal.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	138	--	
Refinery products:			
Gasoline, including natural do	3,042	628	Morocco 189; Zaire 163; Syria 108; Andorra 63.
Kerosine and jet fuel do	907	1,683	United Kingdom 330; Morocco 180; France 160; United States 149.
Distillate fuel oil do	4,335	4,853	Netherlands 560; Morocco 460.
Residual fuel oil do	9,379	7,177	Sweden 1,616; United States 1,417.
Lubricants do	884	79	Switzerland 18; Greece 13; France 11.
Other:			
Liquefied petroleum gas do	689	30	Morocco 19; Portugal 9.
Mineral jelly and wax do	7	6	Morocco 5; France 1.
Petroleum coke do	2,528	--	
Bitumen and other residues do	355	2,808	Italy 1,105; Libya 562; Nigeria 324.
Bituminous mixtures, n.e.s do	56	319	Nigeria 177; Libya 108.
Pitch and pitch coke do	134	78	France 69; Portugal 8.
Unspecified do	21	1,970	Belgium-Luxembourg 295; Greece 87.
Total do	22,337	19,631	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	40,065	19,239	Netherlands 6,572; Italy 5,857; France 3,196.

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[1] Less than 1/2 unit.

Table 3.—Spain: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate	110,294	117,952	Guyana 46,164; Greece 26,320; Ghana 15,892; Surinam 11,987.
Oxide and hydroxide	413,488	432,225	Guinea 254,383; France 44,381; Jamaica 36,157.
Metal including alloys:			
Scrap	3,466	3,108	Portugal 2,519.
Unwrought	36,844	37,972	Canada 10,984; Norway 8,628; U.S.S.R. 8,060.
Semimanufactures	19,631	12,121	Belgium-Luxembourg 3,227; West Germany 2,894; France 1,572.
Antimony:			
Ore and concentrate	1,054	564	Morocco 167; China, Mainland, 141; Bolivia 109.
Metal including alloys, all forms	321	126	Czechoslovakia 90; China, Mainland, 22.
Arsenic:			
Trioxide, pentoxide, acids	492	--	
Metal including alloys, all forms	12	14	NA.
Beryllium metal including alloys, all forms kilograms	380	1	All from United States.
Bismuth metal including alloys, all forms	253	96	Mexico 65.
Cadmium metal including alloys, all forms	[1]	[1]	NA.
Chromium:			
Chromite	112,657	95,576	Republic of South Africa 41,098; India 17,909; Iran 13,403.
Oxide and hydroxide	230	247	West Germany 134; Poland 55; U.S.S.R. 35.
Metal including alloys, all forms	30	4	United Kingdom 3.
Cobalt oxide and hydroxide	138	143	United States 60; Belgium-Luxembourg 54; Canada 23.
Copper:			
Ore and concentrate	188,928	222,248	Guinea-Bissau 96,991; Chile 35,990; Mauritania 25,009.
Copper sulfate	801	1,130	France 790; Czechoslovakia 300.
Metal including alloys:			
Scrap	6,762	11,466	United States 7,929; France 2,126.
Unwrought	86,558	63,709	Chile 22,857; United States 12,404; Belgium-Luxembourg 6,877.
Semimanufactures	21,730	17,088	West Germany 3,188; United Kingdom 2,200; France 2,104.
Gold:			
Ore and concentrate	94	1	NA.
Waste and sweepings kilograms	3	--	
Metal, unworked or partly worked thousand troy ounces	2,572	386	United Kingdom 161; Sweden 96.
Iron and steel:			
Ore and concentrate. except roasted pyrite thousand tons	4,899	4,623	Brazil 1,422; Liberia 1,155; Venezuela 877; Australia 785.
Metal:			
Scrap do	1,998	1,950	United Kingdom 827; United States 515; France 259.
Pig iron, including cast iron	37,092	33,785	Canada 21,367; Brazil 8,093; Finland 1,725.
Sponge iron, powder, shot	9,190	6,526	Sweden 3,193; France 2,393.
Ferroalloys	23,371	34,587	Republic of South Africa 12,782; Sweden 10,588.
Steel, primary forms thousand tons	451	307	Japan 113; West Germany 73; Bulgaria 47.
Semimanufactures:			
Bars, rods, angles, shapes, sections	173,061	139,525	France 20,659; Japan 18,517; Republic of South Africa 14,885.
Universals, plates, sheets	358,728	213,489	West Germany 86,068; France 38,401; Netherlands 30,245.
Hoop and strip	68,686	65,201	France 31,539; West Germany 11,161; Italy 6,487.
Rails and accessories	1,979	1,559	United Kingdom 807; France 371.
Wire	13,937	15,860	France 31,512; West Germany 2,598; France 2,545; Italy 577.
Tubes, pipes, fittings	47,812	31,130	West Germany 10,159; France 8,098; United States 4,428.
Castings and forgings, rough	4,605	3,926	France 1,275; Switzerland 553; United States 415.
Total	668,808	470,690	

See footnotes at end of table.

Table 3.—Spain: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Lead:			
Ore and concentrate	24,372	33,344	Morocco 22,876; Ireland 10,467.
Oxides	395	24	Italy 23.
Metal including alloys:			
Scrap	462	4,024	United States 2,467; Canada 1,510.
Unwrought	1,404	192	France 82; U.S.S.R. 72; West Germany 37.
Semimanufactures	73	141	West Germany 87; France 36.
Manganese:			
Ore and concentrate	433,184	369,679	Ghana 97,592; Republic of South Africa 93,234; Gabon 54,388.
Oxides	1,071	670	Belgium-Luxembourg 396; Ireland 260.
Metal	449	264	Republic of South Africa 142.
Mercury 76-pound flasks	18	23	Austria 10; West Germany 9.
Molybdenum metal including alloys, all forms	29	28	Austria 8; West Germany 4; United States 4.
Nickel:			
Matte, speiss, similar materials	221	289	Finland 178; France 40; Norway 31; Republic of South Africa 29.
Metal including alloys:			
Scrap	24	--	
Unwrought	10,798	6,708	Canada 2,468; Cuba 1,792.
Semimanufactures	487	2,973	West Germany 2,146.
Platinum-group metals and silver:			
Ores and concentrates	37	26	United States 15; Morocco 3; Ireland 2.
Waste and sweepings	333	326	United States 294.
Metals including alloys:			
Platinum-group troy ounces	29,772	43,146	France 27,842; Brazil 12,474.
Silver thousand troy ounces	4,180	2,347	West Germany 704; Belgium-Luxembourg 675.
Rare-earth metals including alloys	31	29	Brazil 14; United Kingdom 10.
Selenium, elemental	50	24	Canada 9; Japan 4; West Germany 3.
Silicon, elemental	23	7	All from Belgium-Luxembourg.
Tellurium, elemental	2	6	Japan 2; U.S.S.R. 2.
Tin:			
Ore and concentrate	6,125	5,083	Indonesia 2,291; United Kingdom 941; Bolivia 894.
Oxides	293	--	
Metal including alloys, all forms	148	79	United Kingdom 27; Malaysia 15; Belgium-Luxembourg 10.
Titanium:			
Ore and concentrate	133,272	106,200	Norway 63,779; Australia 42,421.
Oxides	1,705	1,921	France 479; West Germany 464; Belgium-Luxembourg 390.
Tungsten:			
Ore and concentrate	21	--	
Metal including alloys, all forms	14	17	Austria 4; Belgium-Luxembourg 4; United States 3.
Uranium and thorium metals including alloys, all forms kilograms	101	431	United States 419.
Vanadium:			
Oxides	12	113	West Germany 73; Finland 40.
Metal including alloys, all forms	(1)	--	
Zinc:			
Ore and concentrate	117,343	89,251	Peru 45,500; Ireland 28,224; Bolivia 4,727.
Oxide	527	526	West Germany 304; Italy 167.
Metal including alloys, all forms	870	1,360	Belgium-Luxembourg 810; Bulgaria 194; Italy 113.
Zirconium:			
Ore and concentrate	9,720	20,991	Mainly from Australia.
Metal including alloys, all forms	2	2	Mainly from United States.
Other:			
Ores and concentrates:			
Of molybdenum, tantalum, vanadium	6,394	21	All from Belgium-Luxembourg.
Of base metals, n.e.s	281	344	Burma 161; Republic of South Africa 84; Australia 57.
Ash and residue containing nonferrous metals	33,123	48,796	United States 13,207; France 3,843; Turkey 2,500; Greece 2,412.
Oxides, hydroxides, peroxides of metals	2,153	2,291	West Germany 650; France 606; United Kingdom 368.
Metals including alloys, all forms:			
Alkali and alkaline-earth metals	215	181	West Germany 160.
Pyrophoric alloys	38	--	
Base metals including alloys, all forms, n.e.s.	316	274	United States 126; Belgium-Luxembourg 84.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	2,033	1,878	Greece 985; France 443; Italy 206.

See footnotes at end of table.

Table 3.—Spain: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Abrasives, natural, n.e.s. —Continued			
Dust and powder of precious and semiprecious stones value, thousands	$2,524	$2,908	United States $1,517; Ireland $829.
Grinding and polishing wheels and stones	1,333	1,343	France 348; Italy 202; Austria 193.
Asbestos	106,908	79,811	Republic of South Africa 34,607; Canada 29,325.
Barite and witherite	810	3,326	Italy 2,760; France 565.
Boron materials:			
Crude natural borates	72,981	87,328	Turkey 43,925; United States 41,356.
Oxide and acid	611	39	France 20; Italy 17.
Bromine	40	47	Israel 32; United States 14.
Cement	77,329	97,306	Poland 76,181; France 15,132; West Germany 3,927.
Chalk	7,808	8,529	France 8,225.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	49,390	28,486	Greece 14,727; Morocco 11,944.
Kaolin (china clay)	165,792	165,384	United Kingdom 124,066; France 18,361.
Other	61,053	82,789	United Kingdom 51,272; France 11,807; United States 6,719.
Products:			
Refractory (including nonclay brick)	24,838	21,491	West Germany 7,863; Italy 5,299; Austria 2,181.
Nonrefractory	31,859	38,342	Italy 30,235.
Cryolite and chiolite	529	4,325	All from Denmark.
Diamond:			
Gem, not set or strung value, thousands	$54,117	$49,948	Belgium-Luxembourg $4,041; Israel $3,553.
Industrial do	$1,798	$1,842	Republic of South Africa $675; Israel $279; Zaire $275.
Diatomite and other infusorial earth	2,782	3,127	United States 1,463; France 1,201.
Feldspar	13,639	15,212	France 11,180; Norway 1,801; Republic of South Africa 1,447.
Fertilizer materials:			
Crude:			
Nitrogenous	34,298	26,695	All from Chile.
Phosphatic thousand tons	2,774	2,960	Morocco 2,890.
Potassic	([1])	--	
Manufactured:			
Nitrogenous	83,401	78,151	West Germany 20,539; Norway 19,549; Netherlands 16,700.
Phosphatic	26,668	9,835	Belgium-Luxembourg 7,462; France 1,848.
Potassic	37	1,257	Israel 1,225.
Other, including mixed	42,136	22,429	West Germany 10,960; Netherlands 3,337.
Ammonia	144,492	295,813	United Kingdom 79,253; Mexico 60,628; Belgium-Luxembourg 51,462.
Fluorspar	2	8	West Germany 5; Italy 3.
Graphite, natural	1,095	1,484	Madagascar 604; Italy 328.
Gypsum and plasters	4,847	6,748	France 4,551; Morocco 1,845.
Iodine	96	105	Japan 71; Chile 33.
Lime	150	119	France 116.
Magnesite	50,317	49,080	Greece 21,124; Italy 14,155.
Mica, all forms	1,312	952	France 298; Austria 187.
Pigments, mineral, including processed iron oxides	6,091	6,136	West Germany 5,056.
Precious and semiprecious stones, except diamond:			
Natural value, thousands	$10,372	$10,423	Belgium-Luxembourg $2,857; Thailand $1,266; India $959.
Manufactured do	$810	$567	Austria $221; Switzerland $166; France $84.
Pyrite, gross weight	115	120	All from Italy.
Salt and brines	4,705	2,236	Netherlands 1,003; France 603.
Sodium and potassium compounds, n.e.s	129,470	107,675	France 62,165; West Germany 36,825.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	94,486	97,236	Italy 55,859; Portugal 40,622.
Slate	25	6	All from France.
Other	30,482	27,460	Finland 9,105; Norway 5,427; Brasil 3,727.
Worked:			
Slate	80	194	Italy 123; France 44.
Paving stone and flagstone	49	190	Italy 73; Belgium-Luxembourg 50.
Other	9,186	8,611	Italy 5,452; Portugal 2,170.

See footnotes at end of table.

Table 3.—Spain: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Stone, sand and gravel —Continued			
Dolomite, chiefly refractory grade	3,695	3,563	France 1,950; Norway 1,214.
Gravel and crushed rock	27,570	20,821	Morocco 14,651; France 4,825.
Quartz and quartzite	2,751	5,910	Yugoslavia 4,170; Sweden 1,144.
Sand, excluding metal bearing	20,510	16,171	Morocco 7,916; France 4,790; Belgium-Luxembourg 1,921.
Sulfur:			
Elemental:			
Other than colloidal	178,347	124,651	France 82,104; Mexico 29,774; Canada 6,658.
Colloidal	21	133	West Germany 85; France 47.
Sulfur dioxide	(1)	(1)	NA.
Sulfuric acid	325,696	416,826	West Germany 93,839; Norway 82,967.
Talc, steatite, soapstone, pyrophyllite	15,774	11,980	France 9,640; Norway 1,094.
Other:			
Crude	52,807	73,060	U.S.S.R. 33,610; Greece 18,405; Morocco 8,740.
Slag, dross, and similar waste, not metal bearing	16,001	1,960	West Germany 1,109; Italy 817.
Oxides and hydroxides of magnesium, strontium, barium	1,105	211	West Germany 90; France 43.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	4,974	4,090	France 2,416; Italy 508.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,173	1,087	United States 1,022.
Carbon black and gas carbon	18,219	16,359	France 10,729; United States 1,682; Belgium-Luxembourg 1,028.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	3,946	3,377	Poland 1,370; United States 743; Australia 454.
Briquets of anthracite and bituminous coal	7	10	United Kingdom 8; United States 2.
Lignite and lignite briquets	12,327	6,391	France 6,318.
Coke and semicoke	184,311	247,636	Poland 67,955; Italy 59,880; United States 47,378.
Hydrogen, helium, rare gases	584	148	West Germany 62; United Kingdom 47.
Peat, including peat briquets and litter	9,304	9,726	West Germany 5,468; U.S.S.R. 2,451.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	339,739	354,202	Saudi Arabia 111,443; Iran 66,394; Libya 41,028; Iraq 39,185.
Refinery products:			
Gasoline, including natural do	555	69	Belgium-Luxembourg 64.
Kerosine and jet fuel do	248	2	Mainly from Italy.
Distillate fuel oil do	1,536	1,284	Canada 437; Italy 402.
Residual fuel oil do	1,564	3,845	Netherlands 673; Bulgaria 507.
Lubricants do	295	131	France 53; United Kingdom 38; Belgium-Luxembourg 12.
Other:			
Liquefied petroleum gas do	40,124	24,865	Libya 10,914; France 3,380; Saudi Arabia 2,460.
White spirit do	49	17	Mainly from France.
Mineral jelly and wax do	149	34	France 10; United States 5.
Petroleum coke do	1,396	1,785	United States 1,224; United Kingdom 315.
Bitumen and other residues do	1	16	Albania 15.
Bituminous mixtures, n.e.s do	26	6	United Kingdom 3; France 2.
Pitch and pitch coke do	440	298	West Germany 261.
Unspecified do	1,062	671	Bulgaria 191; Iran 127.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand tons	162	143	United States 129.

NA Not available.

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—The aluminum plant at San Ciprián de Viñas, Province of Lugo, started trial production in December 1979. Designed capacity of about 180,000 tons per year should be reached in 1980. During 1978, through the Bank of Bilbao, the owner, Aluminio Español, S.A., a subsidiary of Empresa Nacional del Aluminio (ENDASA), Aluminio de Galicia, S.A., and others, received a loan of 95 million dollars from a consortium of international banks. The loan will be used for completion of an 800,000-ton-per-year alumina plant under construction at San Ciprián. During 1979, construction of the alumina plant at San Ciprián continued. With the San Ciprián aluminum plant in operation, Spain had five aluminum plants at yearend 1979. The supply of aluminum should exceed demand between 1980 and 1982, and the surplus will be available for export. However, after 1982 domestic demand should increase, and all domestic aluminum is expected to be consumed in Spain. With modest bauxite production and resources, Spain remained largely dependent on imported bauxite and alumina to meet the requirements of the domestic aluminum industry.

Copper.—During 1978 and 1979, the largest producer of copper in Spain, with output close to 30,000 tons of copper in concentrates, Rio Tinto Minera S.A., continued expansion of its mine and mill at Cerro Colorado, Province of Huelva. The expanded mill and mine will enable the company to produce an additional 23,000 tons per year of copper. Development of mines at Aznalcollar and Sotiel are described in the section on pyrite, as part of a large project for recovery of nonferrous metals from complex sulfide ores.

Iron Ore.—Difficulties in the domestic steel industry reflected adversely on the iron mines. However, to improve the country's negative trade balance, expansion of capacity was underway at iron ore mines, owned by various companies, in the Provinces of Granada, Huelva, Badajoz, Teruel, and Guadalajara.

Spain imported about 4-5 million tons per year of iron ore to meet its demand, or about one-half of its requirements. The expansion underway was expected to decrease the imports required to about one-third.

Iron and Steel.—The iron and steel industry of Spain had difficult years during 1978 and 1979. The apparent consumption of steel declined owing to a general slowing of capital investments, particularly in shipbuilding.

The Government of Spain was preparing long-term and short-term plans to aid the steel industry. The long-term steel policy, being finalized at yearend 1978, was expected to be based on new forecasts of consumption, a study of the structure of the steel industry, and studies of the problems of raw materials, fuels, and financing. The short-term plan envisages substantial cash aid to the country's large steelmakers, but not the restructuring which would be necessary if the industry intended to remain competitive after Spain joins the European Economic Community. During 1979, however, the plan was not approved pending further examinations by all concerned.

Cia. Española de Laminación, S.A. (Celsa) started production in a new melting shop and continuous casting facility at its San Andreas de la Barca works near Barcelona. The 80-ton Electromelt furnace was built by Guinea Hnos. The continuous casting machine is a six-strand Concast for 100- to 160-millimeter billets of 5- to 12-meter lengths. Capacity is 200,000 tons per year.

The Spanish roller, Tetracero, owned 47% by ENSIDESA, closed the Castellbisbal (Catalonia) works and was preparing to sell it. In addition, the company shut down its Seville works and was restructuring the installation at Gijon (Asturias).

The steel miniplant of Sidegasa (Siderurgica de Galicia, S.A.) was completed during 1979 at a site in Galicia situated 24 kilometers from Teijeiro, 50 kilometers from La Coruna and 54 kilometers from Santiago de Compostela. Capacity of the new plant is 307,000 tons per year of steel and 255,000 tons of rolled products, of which 80,000 tons will be wire rods, and the rest will be 50,000 tons of merchant bars and 125,000 tons of deformed reinforcing bars. Commissioning of the Sidegasa plant indicates an increase of Spain's electric steelmaking capacity.

Pyrite.—Development of the Aznalcollar complex sulfide ore deposit, in the Province of Huelva, continued during 1978, and in 1979 the mine and plant came onstream. The operating company, Andalusa de Piritas S.A. (APRISA), received from the Government special fiscal benefits for the construction of a 500,000-ton-per-year sulfuric acid plant in Aznalcollar. APRISA obtained a 95% reduction in corporate taxes and a 5-year grace period for repayment of Government loans. When in full production, Aznalcollar will produce 51,000 tons of copper concentrates (25% copper), 42,000 tons of lead (50% lead), and 98,000 tons of zinc concentrates (50% zinc) from 2 million tons of complex sulfide ores and 1.5 million tons of cupriferous pyroclastic rocks. Reports show Aznalcollar proven reserves to be about 44.5 million tons of complex sulfide ores with 0.58% copper, 1.78% lead, 3.3% zinc, and 57 grams of silver per ton of ore; and about 34 million tons of cupriferous pyroclastic rock with about 0.58% copper, 0.40% lead, and 10 grams of silver per ton of ore.

At Sotiel, Huelva, the Government-owned company, Almagrera S.A., continued exploration and metallurgical testing of about 40 million tons of complex sulfide ores. At Huelva, Aprovechiamento Integral de Piritas S.A. (AIP), owned by Union Explosivos Rio Tinto (68.5%), Compañia de Azufre y

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Cobre Tharsis (24.6%), and Metalquimica del Nervion S.A. (6.9%), studied the possibility of recovery of nonferrous metals from pyrite cinder left after roasting to recover sulfur. During 1978 and 1979, the AIP work on development of a 1-million-ton-per-year pellet installation and facilities for recovery of nonferrous metals was slowed because of financial difficulties.

NONMETALS

Bentonite.—Most of the bentonite deposits were located in southern and central Spain. The largest producer was Minas de Gador S.A. (Gador), about 40% owned by Laporte Industries of the United Kingdom. Gador's main source of bentonite was a large mixed deposit containing montmorillonite clay and calcium-based absorbent clay, situated at Serrate de Nijar in Almeria. Annual production was about 36,000 tons of sodium-exchanged bentonite, 12,000 tons of activated bleaching earths, and 12,000 tons of absorbent granules. Other bentonite producers were CECA Española, which produced bentonite in Almeria, and Bentonitas Especiales S.A.-Benesa with production from deposits in the Madrid-Toledo area.

Cement.—During 1978 and 1979, no major events were reported in the cement industry of Spain. The largest cement plant was the 2-million-ton-per-year Barcelona plant operated by Uniland S.A. of Barcelona. Of total capacity (34 million tons per year of cement), Cia. General de Asfaltos y Portland, S.A. (Asland, S.A.), headquartered in Barcelona, owned approximately 14%, and was the largest producer of cement in the country.

Chalk.—Spain's largest natural calcium carbonate-producing areas were located north of Tarragona. Three chalk producers, Reverte-Productos Minerales S.A., Clarianacal S.A., and Jose Andreu S.A., were in operation in the area during 1978. Reverte had capacity to produce about 200,000 tons per year of calcium carbonate products in its plant at Bellvey; products included surface-treated and micronized grades. Clarianacal, a member of the Omya-Plus-Staufer group, operated a 30,000-ton-per-year plant at Arbos. The third producer mined chalk at Bellvey and operated a plant at Montblanch. The Montblanch plant was rated at 50,000 tons per year of products.

Fluorspar.—During 1978 and 1979, Spain was an important producer of fluorspar. However, Fluoruros, S.A. (Bethlehem Steel Corp, 49% holding) had financial problems. A slump of fluorspar prices on international markets, competition, and reevaluation of pesetas against the dollar have made the problems more difficult. Because they were not paid, most of the suppliers of crude ore stopped deliveries, including Minas de Villabona, which had a large mine in operation but not flotation facilities, and Fluoruros Villabona. In addition to these two firms, MINERSA-Minerales y Productos Derivados, S.A., operated a mine at Osor-Gerona, Ribadesella-Asturia, and Beraja-Almeria. Flotation plants at Osor, Ribadesella, and Beraja had an aggregate acidspar capacity of close to 120,000 tons per year.

MINERAL FUELS

During 1978 and 1979, the Government of Spain continued formulation of the Spanish energy plan for a 10-year period, 1978-1987, against a background of increasing scarcity of fuels and constantly rising prices. The energy position of Spain was characterized by an excessive growth rate of energy demand relative to GDP growth rate, insufficient domestic exploration for fuels, heavy dependence on imports, and lack of conservation plans.

At present rates of consumption and without serious conservation, projections foresee a demand for 161 million tons of standard coal equivalent (SCE) in 1987 compared with 97 million in 1977. However, with conservation efforts, the plan predicts a demand of 145 million tons of SEC by 1987 without affecting economic growth. Investments in terms of 1977 pesetas should reach 630,000 million. The plan seeks to reduce oil's contribution to total energy use from 66% in 1978 to 59% in 1987. The nuclear energy program was also scaled down. Only three instead of seven plants will be completed, in view of lower projected demand for electricity. Nevertheless, the share of nuclear power in the total supply of energy in Spain will reach 15% by 1987.

Coal.—During 1978 and 1979, efforts continued to increase domestic production of coal. Lignite deposits at Meira and Puente de Garcia Rodriquez and anthracite mines in northwestern Spain were sites of increased activity. The new Government plan called for an output of about 36 million tons by 1987, or 19.7 million tons of SCE. To assure this supply, the plan calls for encouraging exploration, setting national prices, increasing mechanization in the coal industry, passing clear environmental laws, coordinating construction of thermal powerplants with coal production, assuring coking coal imports, and assisting national railways in purchasing additional rail cars for coal and in building coal-shipping terminals.

Natural Gas.—Domestic output of natural gas was small, and Spain depended heavily on imports to meet its demand. Discoveries of natural gas were announced in the Gulf of Cadiz and Sabiñánigo (Jaca), northern Spain. Preliminary reports indicated natural gas reserves between 20,000 and 40,000 million cubic meters at Sabiñánigo and 9,000 million cubic meters in the Gulf of Cadiz. For a more accurate assessment of the deposits, further drilling was planned.

Work on a natural gas pipeline from Algeria to Spain involved mapping, surveying, and examining possible routes. The consortium for pipeline construction, Segamo, consisted of the Algerian Sonatrach 50%, the Spanish Enagas 25%, and Gaz de France 25%. After crossing into Spain at an as yet undetermined point, the line is planned to join the French national gas network at Laq. Although the details of financing were not worked out, it appeared that Algeria's only contribution to the consortium would be natural gas while the other partners would supply finance and technology.

Petroleum.—Exploration continued offshore Valencia and in the delta of the Ebro River. Chevron found oil with its second well in the Montanazo stepout near its Casablanca offshore field.

Construction was completed of the coking-cracking unit of Chevron's petroleum refinery in La Coruña Province. Investment amounted to approximately $120 million. Installation of a cracking facility in the Enpetrol industrial complex at Puertollano has been announced. Investment reportedly should reach $285 million.

Combining the Spanish state interests in various oil companies was under consideration. The preliminary proposal called for a 100% State-owned company under Instituto Nacional de Industria (INI). The new company would be involved in all aspects of the oil industry from exploration to distribution. This plan was opposed by private interests in the companies concerned, and it was thought that it might conflict with EEC regulations on state monopolies.

Spain was almost completely dependent on imported crude oil to meet its demand in 1978. Ten petroleum refineries, with an installed annual capacity of about 59.6 million tons, were in operation.

Uranium.—Discovery was announced of about 1,200 tons of uranium oxide in ore in the province of Salamanca. In addition, discovery of uranium deposits between Villcastin and Riaza, in Segovia Province, was made public, and a Spanish-French group obtained a mining concession covering approximately 132,000 hectares in the area. Permission was granted for construction of a new uranium concentrator at Saelica el Chico, Province of Salamanca.

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[1] Physical scientist, Branch of Foreign Data.

The Mineral Industry of Sudan

By E. Shekarchi[1]

The mining industry contributed only marginally to Sudan's gross national product of approximately $5.6 billion[2] in 1978-79. However, exploration was underway for both petroleum and minerals. Commercial quantities of chromite, iron ore, cement, gypsum, and salt were produced during 1978 and 1979. Intensive exploration by the Geological Society of Sudan continued on uranium, asbestos, copper, gold, and mica. With only 400 kilometers of paved roads, located mostly in the vicinity of Khartoum, the capital, the Sudan Railway Corporation (SRC) provided the best means of transporting goods and material over Sudan's expanse of sand. A major plan to modernize the Sudanese rail network was incorporated into the Government's Forth Railway Development Plan. During the first phase (1978-80), the European Economic Community was to provide about $11.2 million to help finance the cost of improvements and SCR was to seek an additional $8 million from other sources. Reconstruction work, replacing track and installing new signals, was initiated on the road linking Bahanousa and El Rahad. The 363-kilometer line passes through the semiarid savannah country and serves the Provinces of Darfur and Bahr el Ghazal and the western part of Kordofan Province.

With the noticeable exception of telecommunications, Sudan's infrastructure remained primitive and inadequate. Poor transportation continued to handicap overall economic efficiency and growth; power generation was inadequate for the existing demand and inhibited future growth, particularly in the industrial sector; and lack of water was a constraint to development in some areas.

From a relatively insignificant role in the economy, the industrial sector expanded rapidly in the early and mid-1970's. Since 1977, however, shortages of spare parts, raw materials, and electricity have reduced the growth rate. Output in 1978 and 1979 actually declined, and little improvement was expected in the early 1980's. As a whole, the industrial sector operated at only 30% of capacity, which increased unit costs considerably and threatened a number of firms with bankruptcy.

The cement industry was plagued by technical problems, poor planning, and power shortages, resulting in output well below the 1974 level. Cement shortages seriously affected the construction industry, because no cement was imported owing to lack of foreign exchange. The newly established import substitution industries, producing steel pipes and bars and dry cell batteries, proved particularly susceptible to foreign exchange shortages, and many operated at only 25% of capacity.

Reportedly a project for diamond exploration financed by the U.N. Revolving Fund at a cost of $1.5 million was to begin in 1980. The area being explored in the South-Western region of Darfur was suggested by the Geological Mineral Resources Department of Sudan, from the previous work by this organization.

1978 was the low point for the Sudanese economy. The interim agreement with the International Monetary Fund (IMF) in May 1979, followed by a long-term agreement, changed the Sudan's economic prospects noticeably. A number of policy changes coupled with pledges of new financing produced modest improvements in external accounts which would be accelerated in

1980. The IMF provided about $150 million on the interim agreement and another $150 million under a long-term agreement, while Saudi Arabia provided a $350 million balance of payments grant with the possibility of supplying additional funds later. Western donors pledged significant increases in their bilateral agreements, and the Government of Kuwait provided a commodity loan for the railroad. All of these events were expected to have a significant effect on Sudan's exports in the 1980's.

PRODUCTION AND TRADE

Chromite ore and concentrates, refined petroleum products of distillate fuel and residual fuel, were the main exports of Sudan during 1978 and 1979. In addition some manganese, gold, and mica were exported. The production of minerals in Sudan in 1978 and 1979 is given in table 1.

Sudan continued to evidence a balance of payment deficit, partly because of inadequate foreign assistance in supporting the country's ambitious development programs, and partly due an unfavorable debt structure and inflation. An interim agreement with the International Monetary Fund in 1978 and several internal policy changes improved the economic situation by the end of 1979. Fiscal and monetary restraint and clear import priorities were expected to stabilize the economy in the 1980's. Crude oil imports were primarily from Iraq, and petroleum products were imported from Kuwait. Most fertilizer material was imported under a long-term supply agreement with Kuwait Chemical Fertilizer Co.

Tables 2 and 3 show imports and exports of mineral commodities for Sudan during 1978.

Table 1.—Sudan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
Cement, hydraulic thousand tons	130	187	171	175
Chromium: Chromite concentrate, gross weight	[r]21,873	17,273	18,000	18,000
Gold, mine output, metal content[e] troy ounces	300	300	300	300
Gypsum and anhydrite, crude[e]	18,000	15,300	20,000	20,000
Manganese ore	458	457	450	450
Mica, all grades	550	[e]400	1,000	1,000
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	1,022	1,170	1,211	NA
Jet fuel do	390	275	199	NA
Kerosine do	285	267	193	NA
Distillate fuel oil do	2,348	2,440	3,653	NA
Residual fuel oil do	3,174	3,347	1,858	NA
Other do	135	42	52	NA
Refinery fuel and losses do	640	362	350	NA
Total do	7,994	7,903	7,516	NA
Salt	70,000	91,713	72,000	90,000

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, modest quantities of a variety of crude construction materials (including clays, stone, and sand and gravel) presumably were produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

Table 2.—Sudan: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978
Copper metal including alloys, scrap	50
Fertilizers, crude	400
Lead metal including alloys, scrap	297
Ores and concentrates of base metals	9,000

Table 2.—Sudan: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity		1978
Petroleum refinery products: Lubricants	thousand 42-gallon barrels	109
Pigments, mineral, natural		400
Salt		241
Sodium carbonate, natural		400

Source: The Democratic Republic of the Sudan Foreign Trade Statistics, 1978.

Table 3.—Sudan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1978
METALS		
Aluminum:		
Oxide and hydroxide		354
Metal including alloys, unwrought and semimanufactures		1,176
Copper metal including alloys, unwrought and semimanufactures		113
Iron and steel metal:		
Pig iron, ferroalloys, similar materials		8
Steel, primary forms		7,472
Semimanufactures:		
Bars, rods, angles, shapes, sections		20,671
Universals, plates, sheets		21,399
Hoop and strip		39,860
Wire		941
Tubes, pipes, fittings		1,209
Castings and forgings, rough		300
Lead metal including alloys, unwrought and semimanufactures		975
Nickel metal including alloys, unwrought and semimanufactures		4
Silver	troy ounces	1,061
Other:		
Oxides of zinc and lead, not separated		283
Oxides of manganese, iron, cobalt and titanium, not separated		510
Oxides, hydroxides, peroxides of metals, n.e.s		97
NONMETALS		
Abrasives, natural, n.e.s.:		
Dust and powder of precious and semiprecious stones		49
Grinding and polishing wheels and stones		406
Cement		151,296
Chalk		184
Clays and clay products (including all refractory brick):		
Crude		51
Products:		
Refractory (including nonclay brick)		488
Nonrefractory		2,395
Fertilizer materials:		
Crude, phosphatic		6
Manufactured:		
Nitrogenous		2,351
Phosphatic		126
Ammonia		19
Graphite, natural		14
Lime		36
Mica, crude, including splittings and waste		27
Pigments, mineral, natural, crude		51,547
Sodium and potassium compounds, n.e.s.:		
Caustic soda		4,693
Caustic potash and sodic and potassic peroxides		36
Stone, sand and gravel:		
Dimension stone	value	$608
Sand, excluding metal bearing		44
Sulfur:		
Elemental, all forms		15
Sulfuric acid		874
Other:		
Bromine, chloride, fluorine		109
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s		967
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural		2,224
Carbon black		130
Oxygen, nitrogen, hydrogen, rare gases		2

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Table 3.—Sudan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity		1978
MINERAL FUELS AND RELATED MATERIALS —Continued		
Petroleum refinery products:		
Gasoline:		
Motor	thousand 42-gallon barrels	49
Aviation	do	21
Kerosine	do	56
Distillate fuel oil	do	184
Residual fuel oil	do	9
Lubricants	do	137
Other:		
Mineral jelly and wax	do	2
Bituminous mixtures, n.e.s	do	10
Total	do	468
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		36

Source: The Democratic Republic of the Sudan Foreign Trade Statistics, 1978.

COMMODITY REVIEW

METALS

Chromite.—The Government-owned Ingessana Hills Mine Corp. and the privately owned Blue-Nile Chromium Ltd. were the only producers of chromite during 1978 and 1979. The feasibility study on the Blue Nile chromite deposits, by Mitsubishi in partnership with Japan Metals and Chemical Co., which cost close to $1 million, was somewhat disappointing. Because the chromite deposits were mostly podiform and lacked consistent grade of higher than 48%, the company finally phased out its feasibility program at the end of 1979. However, the company's commitment to erect a ferrochrome plant at a cost of $50 million remained unchanged. No starting date for construction was given. Most of the chromite production was exported to Japan, under an agreement made a couple of years ago. Reportedly, about 9,000 tons of chromite produced by the Ingessan Hills Mining Co. was exported to Switzerland. A potential joint venture to mine 200,000 tons of chromite per year by Sudanese (51%) and Japanese companies (49%) remained uncertain by the end of 1979, owing to lack of proven reserves and lack of infrastructure.

Gold.—Two areas, Jubayt al-Ma'adin and Serkoit, both in the Northern Province of Sudan, were the center of gold mining activities during 1978 and 1979. Reportedly the areas of Gebeit an Um Nabari were also involved. Since gold mining in Sudan was primarily by local operators, families, or partnerships, using very primitive methods, no Government production figures were available, but it is estimated that because of high gold prices on the international market there were sharp production increases. It is of interest to note that prior to 1974 these gold mining areas were considered uneconomical but at the end of 1979 the Sudanese Government and the British firm, Robertson International, were discussing a joint gold mining venture.

Iron Ore.—Mapping and evaluation of the Fodikwan iron ore deposit, north of Port Sudan, and the Sufaya iron ore deposit, in the northern Red Sea Hills, continued during 1978 and 1979. Also, geological investigation progressed on a new discovery at Qarurah with estimated iron ore reserves of about 20 million tons and an average grade of 35% to 40% iron. All of these deposits were considered economical, since they were located within transportation distance of the Red Sea where loading facilities were adequate. The average grade of Sudan's iron ore at Sufaya and Fodikwan was given at 60% to 63% iron. A team of U.S.S.R. geologists working in the Karova area near the coast submitted their final report in 1979. An estimated 25 million tons of iron ore were found. The Government was discussing financing of iron ore mining and beneficiation in this area with the Arab Mining Co., and reportedly some preliminary agreements were reached. With completion of feasibility studies and development of an appropriate international market, Sudan could become a net exporter of iron ore by the mid-1980's. Negotiations continued during 1979 between the Government of Sudan and the Federal Republic of Germany to install a benefication plant in Kordofan Province for iron ore concentrate.

Manganese.—Manganese production remained small, because none of the 28 manganese occurrences was suitable for a large operation. Feasibility studies by the Geological Survey of Sudan to prove the extent of manganese mineralization and estimate reserves progressed in 1978 and 1979. No substantial finding was reported. The local producers resorted to hand cobbing of the ore in order to reach the acceptable grade of 48% for their production. Manganese deposits are found in the Red Sea Hills at Abu Samr, Tolik, Allaikaleib, and Sinkat. They appear as veinlets and pods, which makes the cost of large-scale mining prohibitive.

Uranium.—By the end of 1979, results of exploration activities by Azienda Generale Italiani S.p.A. (AGIP) and Wyoming Minerals Corp., a subsidiary of Westinghouse (U.S.A.), during 1978 and 1979 were not available. However, from fragmentary information given by the Government it was evident that Minex Corp. was successful in discovering an important deposit of uranium and other radioactive elements in Jebel Dumbeir and Jebel Ed Dair, near Rahdad in west-central Sudan. The company started formal discussions with the Government for an agreement to carry out further evaluation of the deposit with a view to future exploration.

NONMETALS

Asbestos.—The asbestos mining evaluation program of the company, shared by Johns-Manville of Canada, Gulf International Group of Kuwait, and the Government of Sudan, continued during 1978 and 1979. Drilling was concluded by the end of 1978, and the preliminary reserves estimate was about 20 million tons of ore with 2.7% asbestos fiber No 4. The mining would be underground, about 160 meters below surface, and a processing plant with 100,000 tons of fiber capacity per year would be installed at the mine site. Total expenditure for exploration, mill, and infrastructure was given at $120 million.

Cement.—Renovation of the Nile Cement Co.'s Rahak plant was completed during 1978 and it produced 65,000 tons in 1979. Even though the amount produced represented only 65% of the planned capacity, the company was expecting a better performance in 1980 by converting the transportation of material from the quarry to the plant over 60 kilometers of dirt road to transportation on the Nile River. This haulage diversion was expected not only to increase availability of material to the plant but also to be more economical.

Construction work on the $53 million Red Sea Cement plant at Derudeb continued during 1979, and production was slated to begin in 1980. The plant capacity was given at 500,000 tons, with feed material to be supplied from the Sayit gypsum deposit, which has proven reserves of 220 million tons. Expansion work on the Maspion Cement Corp's plant in the Northern Province at Atbara continued during 1979. It was anticipated that the plant capacity would be increased from 225,000 to 500,000 tons.

Fertilizer Materials.—The construction status of Sudan's first ammonia-urea complex, which was to start in 1979, remained unclear by yearend. Apparently owing to price increases on the feedstock naphtha, both partners of the project, Sudan's Government (65%) and N-Ren International, had to restudy its economic implications. The plant was to have a capacity of 200 tons per day of ammonia and 300 tons per day of urea. Most of the end products were slated for use in the Gezira agricultural belt.

Mica.—About 1,000 tons of mica were produced in the vicinity of Shereik, where mica occurs in pegmatites as large sheets or more commonly as small scraps. In order to utilize the mica scrap as a commercial product, the Government was seeking financial assistance to install a mica processing plant, including grinding, sorting, and packaging facilities. By the end of 1979 there was no firm commitment on the plant construction. Pegmatites continued to yield the highest production recorded in the country. Apparently a new private company was organized to explore and exploit a new area around the Bayuda Desert region in 1981.

MINERAL FUELS

Petroleum.—Chevron Overseas Petroleum Inc., a subsidiary of Standard Oil of California, was the operator and sole mineral fuel concessionaire for vast areas of the remote central and southern part of the country. The company drilled its first dry well at Baraka, some 50 kilometers south of Muglad. In the second well, located north of Bentiu, at a depth of 14,400 feet some oil show was encountered but not of commercial quality. The third well, to the east of Muglad, was suspended to await the dry season, while the fourth, south of Bentiu, was in progress at the end of 1979. A feasibility study by Bechtel Corp. for a pipeline to connect these oil finds to Port Sudan, a distance of 1,500 kilometers, was undertaken; the Government indicated it is part of the economic study, in case commercial oil is discovered. Chevron was financing its exploration and was to participate with the Government in the profits from any discovery, after the cost had been recovered, to the extent of 25% or 30% depending on output. Exploration was also carried out along Sudan's Red Sea coast by a Texaco, Ball, and Collins group, with Chevron in charge of the actual operation. Of the three offshore wells drilled during 1978 and 1979, two tested noncommercial flows of gas and condensate, while the third was dry. At the end of 1979 concessions along the coast were relinquished.

The Port Sudan refinery, owned 50% by the Sudan Government and 50% by Royal Dutch-Shell and British Petroleum, produced at full capacity during both years. The fate of a second refinery, a joint venture between the Sudan Government and the Saudi Arabian firm Triad Naft, remained unsettled. By the end of 1979 Petroleum General Administration of Sudan was discussing the terms of financing and the capacity of the plant with Petromin of Saudi Arabia, but no agreement was in sight. Sudan imported close to 8 million tons of petroleum products from the Middle East countries, mostly from Iraq and Kuwait.

The only concession awarded during 1979 was to Burmah Oil Exploration and Eastern Petroleum Co., a joint venture, for exploration covering 1,600 square kilometers, in the Tokar Delta region of the Red Sea.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Where necessary values have been converted from Sudanese pounds (£S) to U.S. dollars at the rate of £S1 = US$2.50.

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The Mineral Industry of Sweden

By Joseph B. Huvos[1]

In 1978-79 Sweden's economy grew at a lively pace thanks to an upswing in foreign demand and was followed in this trend by the mineral industry, whose principal products were iron ore, some nonferrous metals, and some fossil fuels.

In 1978, Sweden's gross national product (GNP) was about $102 billion,[2] [3] and the foreign trade balance showed a loss of $400 million. Unemployment was 2.1% at yearend.

Government participation (ownership) in the Swedish mineral industry was about 25% in the gas industry, 75% in iron and steel, and 50% in electric power.

The most important event in Sweden's mineral industry during the period was the formation of Swenskt Staal AB, a 50%-Government-owned steel company designed to improve the efficiency of the fragmented steel industry. One new tungsten mine was opened and two mines, a silver and a complex sulfide ore mine, were closed; there were plans for the closing of two iron ore mines. The capacity of one nonferrous metal mine was expanded, and construction of a modern dry process cement plant was completed.

Indices of Swedish mineral industry production in 1978 and 1979 are shown in the following tabulation (1968 = 100):

Industry sector	1978[r]	1979[p]
Iron ore mining	79	98
Nonmetallic mineral products	83	85
Metal industries	107	112
Mining, quarrying, manufacturing	122	130

[p]Preliminary. [r]Revised.

Source: Monthly Digest of Swedish Statistics. No. 4, 1980, p. 13.

PRODUCTION

In 1978, production of the mineral industry was still at a low level, but in 1979 iron ore and metal production started to increase. Production of mineral commodities in 1976, 1977, 1978, and 1979 is shown in table 1.

Table 1.—Sweden: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum, unalloyed:				
Primary	82,517	82,216	82,000	[3]81,955
Secondary	--	381	NA	NA
Arsenic:				
White, refined	5,800	5,300	[e]5,400	NA
Metallic	1,100	700	[e]700	NA
Bismuth, mine output, metal content[e]	15	15	15	14

See footnotes at end of table.

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Table 1.—Sweden: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS —Continued				
Copper:				
Mine output, metal content	44,860	44,764	47,611	45,822
Metal:				
Smelter:				
Primary	46,481	46,666	53,177	[2]51,055
Secondary	15,565	15,008	13,830	[2]12,900
Total	62,046	61,674	67,007	[2]64,544
Refined:				
Primary	55,566	47,684	52,629	49,676
Secondary	7,301	14,036	11,809	11,000
Total	62,867	61,720	64,438	[2]60,676
Gold:				
Mine output, metal content troy ounces	62,179	67,934	76,294	70,000
Metal including alloys do	147,700	136,705	[e]140,000	NA
Iron and steel:				
Iron ore and concentrate, gross weight:				
Direct-shipping ore thousand tons	17,126	12,845	NA	NA
Concentrate do	12,736	11,994	NA	NA
Total do	29,862	24,839	21,486	[2]26,616
Metal:				
Pig iron and sponge iron[3] do	[r]3,139	2,490	2,481	2,986
Electric-furnace ferroalloys:				
Silicomanganese	7,461	--	--	--
Ferrosilicon	36,726	22,282	--	--
Silicon metal	17,968	12,687	[e]16,000	16,000
Ferrochromium	116,486	134,452	177,000	180,000
Ferrochromium-silicon	5,877	8,456	18,000	20,000
Ferrotungsten	422	487		
Ferromolybdenum	1,830	1,003	2,700	2,700
Ferrovanadium	575	423		
Total	187,345	179,790	213,700	227,700
Steel, crude thousand tons	5,140	3,968	4,325	4,731
Semimanufactures:				
Bars, rods, sections do	1,364	1,210	1,228	NA
Plates and sheets do	1,753	1,345	1,401	NA
Strip do	120	87	93	NA
Rails and accessories do	66	56	62	NA
Pipe and tube stock do	227	207	201	NA
Other, including castings and forgings do	292	349	560	NA
Total do	3,822	3,254	3,545	NA
Lead:				
Mine output, metal content	81,625	88,132	81,900	85,000
Metal, refined:				
Primary	49,068	51,950	45,300	50,000
Secondary	337	80	[e]100	100
Selenium, elemental, refined	60	66	67	60
Silver:				
Mine output, metal content thousand troy ounces	4,617	5,438	5,144	5,000
Metal including alloys do	6,363	6,810	[e]6,500	5,000
Tungsten, mine output, metal content	194	199	[e]580	400
Uranium oxide (U_3O_8)[e]	70	80	80	NA
Zinc:				
Mine output, metal content	128,326	140,233	162,800	164,000
Clinker (70%-75% Zn)	26,100	28,200	NA	NA
NONMETALS				
Cement, hydraulic[4] thousand tons	2,869	2,535	2,348	2,300
Chalk	37,529	36,205	NA	NA
Clays, refractory thousand tons	180	100	NA	NA
Diatomite, calcined	327	--	--	--
Feldspar, salable, crude and ground	44,746	52,167	[e]52,000	52,000
Fluorspar	3,324	2,414	--	--
Gypsum, manufactured	142,800	211,100	NA	NA
Lime: Quicklime, hydrated lime, dead-burned dolomite thousand tons	857	769	[e]940	825
Nitrogen, N content of ammonia do	108	102	96	100
Phosphates: Thomas slag, gross weight do	205	135	NA	NA
Pigments, mineral, natural	1,009	975	NA	NA

See footnotes at end of table.

Table 1.—Sweden: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Pyrite and pyrrhotite (including cuprous), gross weight thousand tons	404	402	484	NA
Sodium compounds:				
Sodium carbonate	900	900	900	NA
Sodium sulfate	103,000	105,000	105,000	NA
Stone, sand and gravel:				
Dimension stone:				
Unworked:				
Limestone and marble thousand tons	34	28	24	NA
Granite and gneiss do.	62	65	65	NA
Quartz do.	29	20	30	NA
Quartzite do.	23	3	NA	NA
Micaceous schist do.	19	20	NA	NA
Sandstone do.	31	33	NA	NA
Other do.	26	15	NA	NA
Worked, all types[3] do.	86	68	NA	NA
Crushed and broken stone:				
Clay slate do.	47	54	NA	NA
Dolomite:				
Crude do.	370	360	NA	NA
Burnt do.	40	25	NA	NA
Granite and gneiss do.	7,826	8,032	NA	NA
Limestone:				
For cement manufacture do.	3,479	3,066	2,635	NA
For lime manufacture do.	881	752	NA	NA
For other industrial uses (including lime marl) do.	2,182	2,268	1,936	NA
Quartz do.	17	15	NA	NA
Quartzite do.	1,795	1,597	NA	NA
Sandstone do.	260	275	NA	NA
Other do.	906	1,036	NA	NA
Sulfur:				
S content of pyrite do.	205	204	233	240
Byproduct:				
From metallurgy do.	[e]140	[e]135	130	130
From other sources do.	28	[e]30	18	20
Total do.	[e]373	[e]369	381	390
Talc and steatite	20,442	21,214	[e]24,000	22,000
Other, crude[6]	5,873	3,104	NA	NA
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	22,992	[e]20,000	NA	NA
Coal, all grades thousand tons	12	12	16	16
Coke, metallurgical do.	1,078	918	933	NA
Oil shale:				
For fuel production use do.	30	12	80	NA
For other use do.	11	6		NA
Peat:				
For agricultural use do.	89	92	95	95
For fuel use do.	32	30	30	30
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	20,893	21,063	21,048	[2]20,944
Jet fuel do.	656	1,094	1,148	[2]1,440
Kerosine do.	39	63	68	[2]85
Distillate fuel oil do.	34,555	37,556	39,012	45,000
Residual fuel oil do.	36,908	39,846	43,293	[2]48,335
Lubricants do.	210	142	214	220
Other:				
Naphtha do.	383	195	511	[2]1,113
White spirit do.	1,717	2,597	2,944	3,000
Unspecified do.	5,320	NA	NA	NA
Refinery fuel and losses do.	6,795	6,771	6,925	7,600
Total do.	109,476	109,347	115,163	127,737

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, cobalt, nickel (as nickel sulfate), and metallic titanium are also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

[3] Production of sponge iron is as follows, in thousand tons: 1976—188; 1977—161; 1978—117; and 1979—NA.

[4] Includes clinker as follows, in thousand tons: 1976—111; 1977—43; 1978—15; and 1979—NA.

[5] Represents material for sale, not that produced.

[6] Includes strontium minerals, unspecified minerals, and fragments of ceramic materials.

TRADE

There was no change in the country's mineral trade pattern. Scandinavia and West European countries remained Sweden's main trading partners. Principal minerals industry export commodities were iron and steel, iron ore, and nonferrous metals. Sweden's total mineral trade in 1977 and 1978 is shown in tables 2 and 3.

Table 2.—Sweden: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite and concentrate	4,123	5,717	Denmark 3,603; Norway 2,104.
Alumina	31	78	Denmark 47; Finland 22.
Metal including alloys:			
Scrap	3,813	2,213	West Germany 1,178; United Kingdom 511.
Unwrought	32,458	38,529	United States 12,061; West Germany 8,339.
Semimanufactures	49,799	57,465	Denmark 9,066; United Kingdom 8,575; Norway 5,628.
Arsenic oxides and acids value, thousands	$2,039	--	
Copper:			
Ore and concentrate	36,220	15,794	All to West Germany.
Metal including alloys:			
Scrap	718	350	West Germany 158; United Kingdom 93.
Unwrought	40,759	29,870	United Kingdom 14,180; Belgium-Luxembourg 5,204.
Semimanufactures	52,041	70,025	United States 12,604; Norway 10,828; West Germany 9,736.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	18,903	22,259	Belgium-Luxembourg 6,254; West Germany 4,575.
Roasted pyrite do	327	355	United Kingdom 205.
Metal:			
Scrap do	75	79	Spain 29; Pakistan 19; Denmark 9.
Pig iron, including cast iron do	256	611	United States 137; Italy 134; China, mainland, 110.
Ferroalloys do	110	168	West Germany 50; Italy 29; Japan 16.
Steel, primary forms do	243	482	United States 90; United Kingdom 81; West Germany 78.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	428	492	West Germany 135; United Kingdom [illegible]
Universals, plates, sheets do	684	601	West Germany 121; United Kingdom [illegible]; Denmark 59.
Hoop and strip do	81	95	West Germany 15; Denmark 10; United Kingdom 6.
Rails and accessories do	21	44	Norway 20; Singapore 7; Italy 6.
Wire do	68	74	United States 12; West Germany 10; Finland 6.
Tubes, pipes, fittings do	14	14	Norway 3; Denmark 2; Finland 1; United Kingdom 1.
Castings and forgings, rough do	28	30	Norway 7; Denmark 4; West Germany 4.
Lead:			
Ore and concentrate	65,421	58,285	West Germany 45,516; Belgium-Luxembourg 7,090.
Oxides	88	161	NA.
Metal including alloys, all forms	49,140	54,746	West Germany 25,503; Netherlands 8,722.
Magnesium metal including alloys:			
Scrap	822	494	United States 243; Italy 129.
Unwrought and semimanufactures	3	14	Denmark 5; Norway 3.
Mercury 76-pound flasks	1,566	754	Netherlands 522; United Kingdom 145.
Molybdenum ore and concentrate	1,241	921	Netherlands 440; United Kingdom 281.
Nickel:			
Matte	358	798	All to United States.
Metal including alloys:			
Scrap	831	498	India 302.
Unwrought	2,549	1,720	Netherlands 1,241.
Semimanufactures	1,417	1,059	France 267; United Kingdom 132.

See footnotes at end of table.

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Table 2.—Sweden: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Platinum-group metals and silver:			
Waste and sweepings value, thousands	$8,312	$11,458	United Kingdom $4,259; West Germany $3,644.
Metals including alloys, unworked or partly worked:			
Platinum-group do	$931	$3,258	United Kingdom $2,017; Finland $464; Netherlands $409.
Silver do	$31,161	$42,041	Finland $775; Denmark $289.
Silicon, elemental do	$8,841	$10,133	NA.
Tin metal including alloys:			
Scrap	--	16	Norway 11; Switzerland 5.
Unwrought and semimanufactures	237	53	Finland 45.
Tungsten:			
Ore and concentrate	86	103	United States 53; United Kingdom 38.
Metal including alloys, all forms	28	49	Austria 27.
Zinc:			
Ore and concentrate	278,905	294,355	West Germany 77,989; Norway 69,828; France 64,755.
Oxide and peroxide	194	461	Norway 207; Finland 88.
Metal including alloys:			
Powder	28	--	
Scrap	4,113	5,241	West Germany 1,968; Norway 1,889.
Unwrought and semimanufactures	427	235	Finland 64; West Germany 46; Norway 42.
Other:			
Ores and concentrates	195	166	Czechoslovakia 130.
Ash and residue containing nonferrous metals	24,921	31,250	Norway 28,436; West Germany 1,087.
Oxides, hydroxides, peroxides of metals	47	59	Finland 47.
Metals including alloys, all forms	1,891	1,818	United Kingdom 323; West Germany 148.
NONMETALS			
Abrasives, natural, n.e.s.:			
Dust and powder of precious and semiprecious stones value, thousands	$54	$53	Finland $22; West Germany $17.
Grinding and polishing wheels and stones	2,322	2,284	West Germany 393; Finland 328; United Kingdom 296.
Asbestos	225	--	
Cement, hydraulic	30,113	18,253	NA.
Chalk	10,802	9,556	Norway 3,244; Denmark 2,729; West Germany 2,140.
Clays and clay products (including all refractory brick):			
Crude	1,263	1,617	West Germany 699; Norway 493.
Products:			
Refractory (including nonclay brick)	26,638	32,444	Finland 10,609; Norway 8,184; Denmark 4,996.
Nonrefractory	25,933	32,391	Norway 12,878; Belgium-Luxembourg 4,486; Denmark 3,060.
Diamond:			
Gem, not set or strung value, thousands	$1,134	$2,072	Finland $1,072; Denmark $324; Belgium-Luxembourg $270.
Industrial do	$38	$181	Italy $100; Iraq $45; United Kingdom $23.
Diatomite and other infusorial earth	98	160	Netherlands 47; Italy 20; Norway 19.
Feldspar, fluorspar, etc	40,589	38,370	United Kingdom 12,968; West Germany 11,224.
Fertilizer materials:			
Crude:			
Nitrogenous	657	--	
Phosphatic	42,187	65,045	Norway 64,994.
Manufactured:			
Nitrogenous[1]	9,968	6,210	Denmark 1,609; United Kingdom 1,004.
Phosphatic	44,476	42,749	NA.
Potassic	1,701	3,371	All to West Germany.
Other, including mixed	9,837	10,255	Norway 5,863; Denmark 2,218; United Kingdom 1,100.
Graphite, natural	40	28	United States 24.
Lime	1,400	1,091	Norway 994.
Magnesite	105	138	Denmark 30; Norway 28.
Mica, including splittings and waste	2	2	Norway 1.
Pigments, mineral: Iron oxides	56	29	NA.
Salt and brines	312	2,619	Denmark 2,077.

See footnotes at end of table.

Table 2.—Sweden: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude or partly worked:			
Marble and other calcareous	3,377	3,752	Denmark 2,420; Netherlands 1,031.
Slate	17,443	15,524	Belgium-Luxembourg 10,438; Norway 2,437; Finland 1,055.
Other, including granite, gneiss, etc	125,059	135,265	Denmark 61,233; West Germany 31,338.
Worked	13,977	14,901	Denmark 11,554; West Germany 1,020.
Dolomite, chiefly refractory grade	3,546	2,088	Norway 732; West Germany 664.
Gravel and crushed rock thousand tons	1,590	1,574	Denmark 840; West Germany 660.
Limestone, except dimension do	1,059	877	Finland 592; West Germany 180; Denmark 104.
Quartz and quartzite	88,887	96,308	Norway 56,318; West Germany 16,610.
Sand, excluding metal bearing	62,262	66,291	Norway 60,146.
Sulfur:			
Elemental, all forms	19,838	17,332	Netherlands 7,096; United Kingdom 7,081.
Sulfur dioxide	13,771	--	
Sulfuric acid	33,349	71,096	Canada 22,570; Netherlands 12,980.
Talc, steatite, soapstone, pyrophyllite	3,812	4,528	United Kingdom 3,506.
Other:			
Crude	10,750	9,704	Denmark 2,940; Norway 2,796; United Kingdom 2,066.
Slag, dross, and similar waste, not metal bearing	117,743	149,365	West Germany 52,477; East Germany 47,162; Norway 36,987.
Oxides and hydroxides of magnesium, strontium, barium	182	52	Denmark 29.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	6,987	8,099	Finland 2,852; Norway 2,848.
Coal (anthracite, bituminous, lignite), including briquets	30,034	31,423	West Germany 10,873; Denmark 7,086; Norway 3,710.
Coke and semicoke	47,850	95,725	Finland 54,031; Netherlands 12,491.
Hydrogen, nitrogen, and rare gases	4,116	1,288	Norway 538; Finland 469.
Peat, including peat briquets and litter	23,994	29,070	Denmark 17,065; Norway 9,365.
Petroleum refinery products:			
Gasoline:			
Motor thousand 42-gallon barrels	3,094	3,324	Denmark 1,513; Norway 1,166.
Aviation do	12	2	All to Finland.
Kerosine and jet fuel do	237	165	Norway 130.
Distillate fuel oil do	2,476	4,485	Denmark 2,474; Norway 906.
Residual fuel oil do	10,211	10,280	Denmark 8,078; United Kingdom 1,223.
Lubricants do	400	322	Norway 151; Denmark 77; Finland 19.
Other:			
Liquefied petroleum gas do	388	611	United Kingdom 298; Denmark 217.
Naphtha do	69	1,219	West Germany 561; Norway 254.
Mineral jelly and wax do	1	2	Norway 1.
Petroleum coke, asphalt, bitumen do	259	252	Denmark 181.
Unspecified do	51	33	West Germany 22; Denmark 10.
Total do	17,198	20,596	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	130,003	134,558	Netherlands 97,008; Denmark 12,858; Norway 9,957.

NA Not available.

[1] Excludes quantities valued at $3,688 in 1977 and $4,008 in 1978.

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Table 3.—Sweden: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate	37,420	58,167	Australia 27,421; Greece 19,834; France 6,091.
Alumina	233,969	185,191	Surinam 58,328; United States 54,702; Jamaica 28,720.
Metal including alloys:			
Scrap	430	2,936	Norway 1,515; Australia 508; Poland 364; United States 283.
Unwrought	47,412	34,168	Norway 23,486; United States 2,137; United Kingdom 1,871.
Semimanufactures	55,083	51,054	West Germany 12,946; Norway 7,421; Australia 3,886.
Chromium:			
Chromite	385,113	558,679	Finland 313,881; Turkey 58,566; U.S.S.R. 57,244; Philippines 52,062.
Oxide and hydroxide	1,146	522	West Germany 459.
Cobalt oxide and hydroxide	5	3	Belgium-Luxembourg 2.
Copper:			
Ore and concentrate	44,738	34,323	Norway 31,305.
Matte	2,563	11,616	France 11,608.
Metal including alloys:			
Scrap	2,817	4,075	France 2,373; Norway 455; Denmark 441.
Unwrought	51,810	74,720	Belgium-Luxembourg 14,992; Zambia 13,492; Chile 11,069.
Semimanufactures	31,953	32,922	United Kingdom 7,606; West Germany 6,505; Finland 4,830; Poland 4,219.
Iron and steel:			
Ore and concentrate, except roasted pyrite	120,000	121,000	All from Liberia.
Metal:			
Scrap	32,620	117,642	United Kingdom 35,396; Netherlands 31,836; West Germany 22,274.
Pig iron, including cast iron	88,962	47,625	U.S.S.R. 16,121; Finland 10,575; Brazil 4,189; Norway 3,354.
Ferroalloys	95,268	137,758	Norway 69,988; Republic of South Africa 12,256; Finland 10,706; U.S.S.R. 9,844.
Steel, primary forms	122,334	108,776	Finland 81,156; West Germany 7,205; France 3,994.
Semimanufactures:			
Bars, rods, angles, shapes, sections	287,378	322,482	West Germany 69,573; Belgium-Luxembourg 39,148; United Kingdom 35,550.
Universals, plates, sheets	257,857	285,625	Belgium-Luxembourg 46,219; West Germany 45,088; Finland 42,560.
Hoop and strip	106,860	163,890	West Germany 41,357; Norway 23,998; France 22,710.
Rails and accessories	2,479	2,681	West Germany 1,176; United Kingdom 875.
Wire	29,957	22,066	Belgium-Luxembourg 4,890; United Kingdom 4,828; West Germany 3,299.
Tubes, pipes, fittings	27,279	27,750	West Germany 10,683; United Kingdom 5,823; France 4,368.
Castings and forgings, rough	33,832	27,759	Poland 6,190; West Germany 4,452; Norway 3,851; Denmark 3,020.
Total	736,642	852,253	
Lead:			
Oxides	1,912	1,930	West Germany 1,074; United Kingdom 471.
Metal including alloys:			
Scrap	6,030	5,045	Canada 3,772; Norway 870.
Unwrought	3,251	1,691	West Germany 544; Denmark 439.
Semimanufactures	1,047	1,144	West Germany 922.
Magnesium metal including alloys:			
Scrap and unwrought	1,747	1,746	Norway 1,432.
Semimanufactures	63	59	West Germany 13; Denmark 11; Austria 9; United Kingdom 9.
Manganese:			
Ore and concentrate	9,424	3,199	Netherlands 2,810.
Oxides	590	429	Belgium-Luxembourg 166; Greece 135.
Mercury 76-pound flasks	319	725	Spain 377; China, mainland, 174.
Molybdenum:			
Ore and concentrate	5,305	6,484	United States 2,290; Netherlands 2,066; Belgium-Luxembourg 1,063.
Metal including alloys, all forms	119	75	Belgium-Luxembourg 21; Austria 18.

See footnotes at end of table.

Table 3.—Sweden: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Nickel:			
Matte	2,438	5,329	Australia 2,990; U.S.S.R. 1,566.
Metal including alloys:			
Scrap	2,322	2,020	United Kingdom 638; West Germany 651; United States 484.
Unwrought	8,208	8,326	United Kingdom 2,485; Canada 1,561; United States 669; Japan 666.
Semimanufactures	3,992	1,144	United Kingdom 622; Australia 90; West Germany 86.
Platinum-group metals and silver:			
Ores and concentrates	4,319	4,009	Peru 3,053; Chile 776.
Waste and sweepings	442	269	United States 177.
Metals including alloys, unwrought or partly worked:			
Platinum-group .. value, thousands	$12,443	$20,039	Switzerland $7,191; United Kingdom $5,385; United States $3,768.
Silver do.	$16,629	$23,019	West Germany $7,167; United Kingdom $5,185; Norway $2,831.
Tantalum do.	$65	$19	NA.
Tin:			
Scrap	21	--	
Oxide	26	--	
Metal including alloys:			
Scrap and unwrought	358	336	Malaysia 160; West Germany 95.
Semimanufactures	202	174	United Kingdom 96; West Germany 55.
Titanium:			
Ore and concentrate	2,718	1,448	Australia 781; Republic of South Africa 460.
Oxide	3,807	4,530	Norway 1,519; Finland 1,326.
Tungsten:			
Ore and concentrate	2,665	2,420	Brazil 715; Australia 623; China, mainland, 485.
Metal including alloys, all forms	103	44	Peru 20; West Germany 9; Japan 5.
Zinc:			
Ore and concentrate	2,716	9,103	Ecuador 8,167; United Kingdom 936.
Oxide	1,566	1,488	Netherlands 306; East Germany 290; United Kingdom 288.
Metal including alloys:			
Blue powder	423	458	Norway 457.
Scrap	109	--	
Unwrought	34,416	39,439	Norway 18,142; Finland 14,902.
Semimanufactures	804	441	West Germany 160; France 152.
Other:			
Ores and concentrates	665	999	Republic of South Africa 595; Australia 404.
Ash and residue containing nonferrous metals	69,164	39,044	Spain 14,006; West Germany 10,210; France 5,789.
Oxides, hydroxides, peroxides of metals	1,873	2,255	Finland 995; United Kingdom 538.
Metals including alloys, all forms	4,067	4,434	Republic of South Africa 993; U.S.S.R. [illegible]; United Kingdom 337.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	848	1,055	Ireland 709.
Dust and powder of precious and semiprecious stones ..... value, thousands	$1,769	$2,432	United States $1,326; Switzerland [illegible]; Republic of South Africa $419.
Grinding and polishing wheels and stones	2,270	2,345	Austria 716; United Kingdom 655.
Asbestos	2,555	1,334	Canada 1,134.
Barite and witherite	5,390	4,660	West Germany 3,185; United Kingdom 1,210.
Boron:			
Crude natural borates	19,618	21,012	United States 15,823; Turkey 5,178.
Oxide and acid	531	780	France 582; United States 183.
Cement	30,745	99,689	Finland 48,127; Poland 38,378.
Chalk	20,366	26,541	United Kingdom 10,674; Denmark [illegible]
Clays and clay products (including all refractory brick):			
Crude	294,075	298,802	United Kingdom 254,910.
Products:			
Refractory (including nonclay brick)	97,080	97,086	Austria 24,605; West Germany [illegible]; United Kingdom 18,705.
Nonrefractory	31,148	28,487	Italy 8,063; Denmark 6,110; West Germany 5,278.
Cryolite and chiolite	810	654	Denmark 537; Greenland 117.
Diamond:			
Gem, not set or strung value, thousands	$16,706	$19,664	Belgium-Luxembourg $8,496; Israel $5,129.
Industrial do.	$1,061	$1,165	United Kingdom $670; Republic of South Africa $354.

See footnotes at end of table.

Table 3.—Sweden: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Diatomite and other infusorial earth	3,944	4,111	Denmark 1,764; United States 1,150; Spain 458.
Feldspar, fluorspar, etc	22,176	20,817	France 6,484; Norway 4,924; China, mainland, 2,596; Spain 2,214.
Fertilizer materials:			
Crude:			
Nitrogenous	17,682	9,354	Chile 9,337.
Phosphatic	584,049	574,411	U.S.S.R. 169,150; Morocco 163,750; United States 88,914.
Manufactured:			
Nitrogenous	540,229	486,091	Norway 433,928.
Phosphatic	3,204	2,636	Israel 2,242.
Potassic[1]	568	920	All from West Germany.
Other, including mixed	73,151	91,604	Norway 77,171; West Germany 8,673.
Ammonia	118,002	126,640	Norway 48,249; Trinidad and Tobago 25,009; Mexico 24,942.
Graphite, natural	856	560	West Germany 212; Austria 160; Norway 104.
Gypsum and plasters	309,053	258,278	Spain 164,366; U.S.S.R. 60,606; East Germany 24,288.
Lime	2,785	3,190	West Germany 1,548; Belgium-Luxembourg 672; Denmark 649.
Magnesite	3,898	21,645	Norway 9,539; Greece 3,930; Spain 2,665; United Kingdom 1,493.
Mica, all forms	458	433	Norway 140; India 66; United Kingdom 58.
Pigments, mineral:			
Natural, crude	79	--	
Iron oxides, processed	7,503	7,890	West Germany 7,193.
Precious and semiprecious stones, except diamond value, thousands	$1,060	$1,119	Switzerland $263; France $187; Australia $177.
Pyrite, unroasted	59,715	60,372	Norway 60,242.
Salt and brines thousand tons	1,309	1,251	Netherlands 410; West Germany 320; Poland 192.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	75,351	66,179	Belgium-Luxembourg 28,981; West Germany 14,001.
Caustic potash	2,259	966	West Germany 661; France 259.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous stone	439	486	Italy 214; Belgium-Luxembourg 125; Denmark 125.
Slate	1,629	1,543	Norway 1,471.
Other, including granite, gneiss, etc	3,616	3,347	Finland 1,705; Norway 922; Republic of South Africa 448.
Worked, all types	10,236	8,870	Portugal 3,385; Italy 1,978; Poland 1,795.
Dolomite	113,639	86,542	Norway 50,105; United Kingdom 29,160.
Gravel and crushed rock	227,170	92,280	Finland 47,633; Denmark 19,978.
Limestone, except dimension	73,237	82,106	United Kingdom 57,020; Denmark 18,322.
Quartz and quartzite	29,035	27,551	Spain 15,420; Greece 11,638.
Sand, excluding metal bearing	428,532	485,333	Denmark 172,907; Belgium-Luxembourg 151,852; Finland 141,197.
Sulfur:			
Elemental, all forms	59,622	58,287	Poland 57,516.
Sulfur dioxide	4,579	--	
Sulfuric acid, including oleum	23,204	5,595	Finland 4,544; Norway 658.
Talc, steatite, soapstone, pyrophyllite	18,857	18,795	Finland 7,243; Norway 6,089.
Other:			
Crude	79,286	79,979	Norway 41,166; West Germany 32,746.
Slag, dross, and similar waste, not metal bearing	19,159	14,889	Spain 13,987.
Oxides and hydroxides of magnesium, strontium, barium	16,997	862	East Germany 710.
Bromine, iodine, fluorine	15	19	Israel 9; Japan 6.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	902	750	United States 409; Trinidad and Tobago 341.
Carbon black	7,378	8,017	West Germany 4,111; United Kingdom 1,858; Netherlands 848.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	1,400	1,543	U.S.S.R. 469; West Germany 272; Poland 243.
Lignite and lignite briquets	5,298	6,099	East Germany 3,248; Australia 2,851.
Coke and semicoke thousand tons	752	422	West Republic Germany 200; United Kingdom 118.
Hydrogen, helium, rare gases	4,534	2,915	Netherlands 1,619; West Germany 1,218.
Peat and peat briquets	7,161	5,586	U.S.S.R. 4,058; Denmark 999; Finland 515.

See footnotes at end of table.

Table 3.—Sweden: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	105,574	115,283	Saudi Arabia 24,678; United Kingdom 20,105; United Arab Emirates 15,42
Refinery products:			
Gasoline:			
Motor do.	12,029	12,958	Denmark 4,212; Finland 3,069; Belgium-Luxembourg 2,016.
Aviation do.	276	182	Netherlands 122; Italy 42.
Kerosine and jet fuel do.	4,417	4,639	United Kingdom 1,838; Belgium-Luxembourg 1,312.
Distillate fuel oil do.	37,229	32,834	U.S.S.R. 6,775; United Kingdom 5,431; Venezuela 4,359.
Residual fuel oil do.	58,271	33,634	U.S.S.R. 13,700; United Kingdom 5,789; Libya 2,490.
Lubricants do.	2,016	2,305	West Germany 400; Netherlands 396; United Kingdom 303.
Other:			
Liquefied petroleum gas do.	958	726	United Kingdom 363; Saudi Arabia 109; Denmark 74; Norway 60.
Naphtha do.	7,459	7,438	United Kingdom 2,170; Saudi Arabia 1,711; Italy 771.
Mineral jelly and wax do.	103	113	West Germany 55; United Kingdom 15.
Petroleum coke, asphalt, bitumen do.	728	1,620	United States 759.
Unspecified do.	512	540	U.S.S.R. 205; Netherlands 186.
Total do.	123,998	96,989	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	50,788	59,351	West Germany 22,101; Netherlands 12,520; United Kingdom 5,639.

NA Not available.
[1] Includes potassic material valued at $15,098 in 1977 and $16,225 in 1978.

COMMODITY REVIEW

METALS

Aluminum.—During 1978-79 primary and secondary metal production ran near capacity.

Gränges AB and Alcan Aluminium Ltd. of Canada concluded an agreement whereby Gränges acquired the 21% Alcan holding in Gränges Essem AB, a Gränges subsidiary, for $26 million. Gränges owned Sweden's only aluminum reduction plant, located at Kubikenborg, near Sundsvall, on the Baltic; capacity of the plant was 85,000 tons per year.

Arsenic.—Environmental considerations necessitated a reduction in Boliden's arsenic metal production to 75% of its capacity of 1,200 tons per year in 1979. Boliden still remained the world's largest producer. Arsenic trioxide production was 20,000 tons in 1968, but has recently fallen to 6,000 tons per year.

Copper, Lead, and Zinc.—Boliden announced a $22.7 million investment in its 55,000-ton-per-year lead smelter at Rönnskär. The largest portion of the investment would go towards a fluidized bed roaster and a top blown converter which were to increase capacity of the smelter by an additional 15,000 tons of lead per year.

Boliden also decided to spend $35 million on increasing the capacity of its Aitik copper mine from 8 million tons to 11.3 million tons of ore per year.

The processing plant was rebuilt in 1978 at Boliden AB's Laisvall mine, raising ore capacity to 1.5 million tons per year.

The concentrator of Boliden's Stekenjokk mine, located on the Norwegian border, was expanded, raising its capacity by 50%. Boliden's Hällefors silver mine and Grängesgruvan metal mine, in central Sweden were closed.

In 1978, Luossavaara Kirunavaara AB (LKAB) test-mined its copper deposit at the Viscaria Mine near Kiruna. Drilling

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physical measurements, and mapping were also performed. Prospecting for base metals was carried out by LKAB in the Arjeplog area, near Laisvall. Exploration work, completed in 1979, was also performed on a copper-cobalt deposit at Haakansboda, about 2 kilometers south of Straassa.

Boliden continued to account for most nonferrous metals mined and produced in Sweden and operated the country's only large nonferrous smelter at Rönnskär or the Gulf of Bothnia near Skelleftea. Vieille Montagne accounted for 30% of the country's zinc ore production; zinc concentrates were exported for processing at the company's Belgian plants.

Iron Ore.—In 1978, iron ore production slumped further to 18 million tons, although exports, aided by strikes at Canadian mines, and domestic consumption had picked up somewhat. Due to these circumstances iron ore stocks were reduced from 18 to 15 million tons. The f.o.b. price of iron ore was 66 to 69 kroner ($14.67 to $15.33 per ton), down by 14% from 1977, as the price was tied to the exchange rate of the U.S. dollar. In 1979 iron ore production increased by about one third because a continued improvement in foreign demand had decreased stocks.

In 1978, investments in the iron ore mining industry were $53 million compared with $118 million in 1977, because a few large projects, such as the extension of the Narvik harbor and the Svappavaara processing plants, were completed.

The Swedish Government proposed to the Parliament that it provide $200 million for LKAB's financial reconstruction, for losses, and as an employment subsidy.

The Svappavaara iron ore mine in Swedish Lappland was reopened in October 1978 by LKAB. The Svappavaara pelletizing plant had been processing Kirunavaara ore during the mine's shutdown. LKAB also planned to build a new pellet plant at Kiruna, at a cost of about $100 million.

An intensive core drilling program was undertaken in Kiruna to delineate and sample ores down to the 775-meter level. Deep drilling from the 795-meter level down to 1,000 meters and deeper was started.

Stora Kopparberg Bergslags AB reported that when Svenska Kugellager Fabriken AS shut down its blast furnance at Hofors, Gastrikland, in 1978, the market for Stora Kopparberg's Vintjärn concentrate was lost. The mine was closed and allowed to flood, ending iron ore mining at Stora.

Svenskt Staal AB has taken over Gränges Gruvor AB's Exportfält Mine and Stora Kopparberg's Riksbergsfält Mine in central Sweden. There were plans to concentrate all hoisting and processing at Exportfält in 1980; for the moment both mines are shut down and 100 persons have been dismissed.

At Straassa, in Örebro County, a new crushing plant was installed.

There were plans to close the Blötberg iron ore mine, in Ludvika County, after 78 years of operation.

At Stora's Falu Mine, production of pellets from roasted pyrite was discontinued.

Fagersta AB decided to close down the Smältermossan high-sulfur iron ore mine, in Falun County.

Iron ore ports in Sweden included LKAB'S Luleaa terminal for loading vessels up to 45,000 deadweight tons at a rate of 4,000 tons per hour from a 5-million-ton storage area, and Svenskt Staal's Oxelösund terminal for loading ships up to 75,000 deadweight tons at a rate of 3,000 tons per hour from a 1-million-ton storage area.

Iron and Steel.—On January 1, 1979, Svenskt Staal AB (SSAB) came into existence. The merger of the predecessor companies was necessary because of inability to compete with growing steel industries in Sweden's traditional foreign markets, and because of poor Volvo sales and consequent low domestic demand for steel. The new company was formed by the merger of the Government-owned Norrbottens Järnverk AB (NJA) and the steel plants, iron mines, and other related facilities of two large private companies: Gränges AB, which owned the Oxelösund steel mill near Nyköping, and Stora Kopparberg Bergslags AB, which owned the Domnarvets steel mill near Borlänge. SSAB is a joint venture of Government and private industry, with the Government owning 50% of its capital stock and the two private companies, Gränges and Stora Kapparberg, owning 25% each. It was understood that SSAB was not to compete unfairly with the country's remaining smaller, privately owned steel companies through the help of Government grants. Finally, in 1978, Fagersta AB decided to discontinue ore-based carbon steel production at its Fagersta plant; in the future only pig iron and scrap will be used at the plant.

High-carbon ferrochromium production in Sweden was in the hands of two wholly owned subsidiaries of U.S. companies: Airco Alloys AB, owned by Airco Inc., Montvale, N.Y., had a capacity of 117,000 tons of high-carbon ferrochromium (chromium content); and AB Ferrolegirengar, owned by Metallurg Inc., New York, had a capacity of 39,000 tons per year.

Following completion of a share transaction, the Swedish special steel producers, Fagersta AB and Sandvik AB, were to increase their collaboration; previous mutual rationalization agreements had already covered a wide range of their production. Kinnevik, a major Sandvik shareholder, now controls a 20% share of the equity of Fagersta, which represents a 40% share in voting rights.

Tungsten.—LKAB's Wigström tungsten mine, at Sandudden near Yxsjöberg, started operations. The ore is trucked to the company's concentrating plant at Yxsjöberg for processing. Test mining of tungsten ore started in 1979 at LKAB'S Norra Hörken Mine near Ludvika.

NONMETALS

Apatite.—In 1978, construction began on a processing plant designed to produce apatite concentrate from the nonmagnetic fraction of the pelletizing ore at Kiruna. The plant is ultimately to produce 200,000 tons of apatite concentrate per year.

Cement.—In 1978, cement shipments declined further to about 70% of present plant capacity. Construction of a new dry process cement plant was completed in 1979 at Slite, Gotland Island; the plant replaces four obsolete plants and leaves a total of three plants in opearation with a total capacity unchanged at about 3.5 million tons per year. During the period Sweden's cement industry was operated by Industri AB Euroc, owned by Cementa AB (95%); LKAB was a minority coowner of Cementa (5%) and also operated four limestone plants.

Industrial Minerals.—In 1978, dolomite pellets were prepared on an experimental basis at LKAB's Svappavaara Mine.

Höganas AB reported that clinker clay mining at the company's Bjuv Mine, near Helsingborg, ran at a reduced rate due to an accumulation of stocks.

Ytong AB continued production of quartz-sandstone at Kvantorp and marble at Glanshammar and Brannlyckan in Bergslagen Province.

MINERAL FUELS

In 1978-79 about one-fifth of Sweden's energy was supplied by domestic hydroelectric power and fuelwood. The remainder was from imported oil, coal, and enriched nuclear fuel. Supply and apparent consumption of fuels and power in 1978 are shown in table 4.

Table 4.— Sweden: Supply and apparent consumption of fuels and power for 1978

(Million tons of standard coal equivalent)

	Total energy	Coal and coke	Petroleum and refinery products	Black liquor fuelwood and waste	Hydroelectric power[1]	Nuclear power[2]
Production[3]	12.4	--	--	5.4	7.0	--
Imports	34.2	2.0	28.9	--	.5	2.8
Exports	4.2	.1	3.5	--	.6	--
Apparent consumption	42.4	1.9	25.4	5.4	6.9	2.8

[1] Includes foreign trade of all electric power.
[2] Thermal burnoff of imported uranium fuel.
[3] Includes only primary energy.

Source: Foreign Trade 1978. Monthly Bulletin. December 1978, p. 14.

Nuclear Power.—For the first time nuclear power had more supporters than opponents, as released in a 1978 survey on energy by the Swedish Institute for Public Opinion Polls. However, the controversy on nuclear power led to the fall of the conservative Fälldin Government, which had favored limited use of nuclear power.

Five nuclear powerplants were operating in the country with a total capacity of about 3,800 Megawatts electrical (MWe). Five additional nuclear powerplants, with a capacity of 4,340 MWe, were under construction.

Natural Gas.—If approved by the Danish and Swedish Parliaments, a project to bring Danish natural gas to Sweden will be started. A pipeline will be built to transport up to 200 million cubic meters of natural gas per year to south Sweden, by crossing the Öresund between Dragör south of Copenhagen and Klagshamn south of Malmö. Later on, the line should also transport Norwe-

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gian North Sea gas from the Federal Republic of Germany to Sweden.

Petroleum.— Government-controlled Svenska Petroleum AB's Oil Prospecting, Inc. (OPAB) concluded a long-term crude supply contract with Iraq, the first Swedish contract since the Iran crisis; initial deliveries of 400,000 tons in 1979 were to be increased each year as necessary. Sweden was also in the process of expanding its underground crude oil storage capacity by 9.6 million cubic meters. One new 1.2-million-cubic-meter storage emplacement at Göteborg was already filled. Other storage emplacements, to be completed soon, included an 800,000-cubic-meter facility at Nynashamn, another of 2.6 million cubic meters at Brofjorden, and a third of 1 million cubic meters at Göteborg.

In 1978 OPAB's record 30-well drilling program, all on Gotland Island, produced only one small oil find. Seismic work was carried out in 1979 on Gotland and offshore Angelholm, in the Kattegat, in southwest Skaane Province, and in the Baltic between southeastern Skaane Province and Bornholm Island. On Gotland, a low-cost exploratory drilling system was employed using 50-millimeter holes drilled with core drilling equipment mounted on a twin-axle trailer.

Because of the shallowness of the Danish Straits, supertankers cannot reach Swedish oil terminals along the Baltic coast, and these terminals have therefore no supertanker facilities. Only Göteborg can receive tankers as large as 350,000 tons; there are plans for expanding capacity there eventually to 500,000-ton tankers. The Swedish Government also had plans to use empty tankers for the storage of oil.

The companies OK and Texaco, joint owners of the Scarnraff refinery at Lysekill, southwest Sweden, started to expand its capacity during 1979 from the current 8.3 million tons per year to 10 million tons per year.

Sweden's four oil companies operated six oil refineries with a total capacity of about 21 million tons per year.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from U.S. dollars to Swedish kroner (SKr) at the rate of SKr4.51=US$1.00 for 1978 and SKr4.28=US$1.00 for 1979.

[3] U.S. Embassy, Stockholm, Sweden. State Department Airgram A-65, Oct. 23, 1979, p. 2.

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The Mineral Industry of Switzerland

By Roman V. Sondermayer[1]

During 1978-79, cement, lime, gypsum, salt, and sand and gravel were produced from domestic raw materials in Switzerland, and the industry processed imported crude oil, alumina, and iron and steel raw materials. Imported fuels supplied most of the energy of the country, and hydropower and fuelwood were the only domestic energy sources. About 2% of the gross national product (GNP) was credited to the mineral industry of Switzerland, and roughly 1% of the labor force was employed by the mineral industry, including processing. Except for some exploration for oil and gas, 1978-79 were uneventful years for the Swiss mineral industry.

PRODUCTION

The minerals industry was privately owned, and for the most part, was modern and efficient. The tabulation below shows principal companies in operation in Switzerland during 1978-79, and table 1 shows variations in production of minerals.

Commodity	Major companies-principal facilities (ownership)	Percent of domestic output
Aluminum	Schweizerische Aluminium A.G.-ALUSUISSE - plants at Steg and Chippis.	80
Cement	Cement Werk Wuerenlingen - plant at Siggenthal	36
Petroleum, refined	Raffinerie du Sud Ouest S.A. - refinery at Collombey (PB, ENI, Esso).	40
	Raffinerie de Cressier S.A. - refinery at Cressier (Shell, Gulf).	40
	Raffinerie Rheintal S.A. - refinery at Sennwald (ENI, Italy).	20
Steel, crude	Von Roll Ltd. - plants at Geralafingen and Bodio	75

Table 1.—Switzerland: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity[1] and unit of measure	1976	1977	1978[p]	1979[e]
METALS				
Aluminum metal smelter, primary ……… tons	78,172	79,751	79,468	82,972
Iron and steel metal:				
Pig iron and blast-furnace ferroalloys	23	27	35	--
Electric-furnace ferroalloys[e]	5	5	6	5
Crude steel	545	695	784	806
Semimanufactures[e]	547	620	679	680
NONMETALS				
Cement, hydraulic	3,546	3,649	3,697	3,700
Gypsum[e]	70	70	70	70
Lime	71	66	68	70
Nitrogen: N content of ammonia	45	45	45	45
Salt	312	366	391	390
Sodium compounds: Sodium carbonate ……… tons	45,000	45,000	45,000	45,000
Sulfur, byproduct, all sources ……… do	2,000	2,000	3,000	3,000
MINERAL FUELS AND RELATED MATERIALS				
Gas, manufactured ……… million cubic feet	2,984	2,308	1,808	1,800
Petroleum refinery products:				
Gasoline ……… thousand 42-gallon barrels	8,415	8,475	7,434	NA
Jet fuel ……… do	1,376	1,512	1,604	NA
Kerosine ……… do	39	39	--	NA
Distillate fuel oil ……… do	15,957	14,278	13,457	NA
Residual fuel oil ……… do	7,333	6,747	5,354	NA
Other ……… do	2,186	2,103	2,265	NA
Refinery fuel and losses ……… do	1,469	1,318	1,200	NA
Total ……… do	36,775	34,472	31,314	31,500

[e] Estimate. [p] Preliminary. NA Not available.

[1] In addition to the commodities listed, a variety of crude construction materials (common clay, sand and gravel, and stone) is undoubtedly produced, but output is not reported and available general information is inadequate to make reliable estimates of output levels.

TRADE

Switzerland was a significant trader in minerals and related commodities, but such trade did not reflect accurately the activities of the country's mineral industry or the needs for minerals. Many of the transactions recorded were commercial in nature (imports for reexport only). The United States had a positive trade balance in minerals trade with Switzerland. Tables 2-3 show the trade of Switzerland in minerals.

Table 2.—Switzerland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Oxide and hydroxide	184	163	Italy 32; Belgium-Luxembourg 26; West Germany 24.
Metal including alloys:			
Unwrought	29,027	32,876	West Germany 14,461; Italy 11,256; United Kingdom 1,973.
Semimanufactures	68,621	66,038	Austria 12,053; Germany 10,189; France 6,946.
Antimony metal including alloys, all forms ……… kilograms	79	1,312	France 1,143.
Arsenic trioxide, pentoxide, acids	1	--	
Beryllium metal including alloys, all forms ……… kilograms	56	15	West Germany 4.
Chromium oxide and hydroxide	13	79	Do.
Cobalt oxide and hydroxide	7	10	West Germany 10.
Copper:			
Matte	826	556	Italy 424; West Germany 100; Austria 32.
Copper sulfate	57	106	France 47; West Germany 26; Netherlands 14.
Metal including alloys:			
Scrap	6,632	4,972	Austria 2,004; West Germany 1,722; Italy 615.

See footnotes at end of table.

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Table 2.—Switzerland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Copper —Continued			
Metal including alloys —Continued			
Unwrought	5,362	4,809	West Germany 3,689; Italy 984.
Semimanufactures	16,635	16,529	West Germany 2,982; France 2,388; Italy 2,102.
Gold metal, unworked or partly worked thousand troy ounces	2,640	187	Israel 66; West Germany 42; Portugal 25.
Iron and steel:			
Ore and concentrate, including roasted pyrite	224	41	West Germany 14.
Metal:			
Scrap	61,938	88,080	Italy 67,148; West Germany 11,283; France 7,979.
Pig iron, ferroalloys, similar materials	1,485	2,380	Poland 1,317; West Germany 766; Portugal 89.
Steel, primary forms	15,812	22,394	West Germany 12,261; France 9,953; Italy 179.
Semimanufactures:			
Bars, rods, angles, shapes, sections	165,987	236,721	West Germany 173,254; France 22,136; Austria 18,266.
Universals, plates, sheets	18,389	22,752	West Germany 16,559; Austria 3,232; France 689.
Hoop and strip	17,834	18,122	Austria 9,502; West Germany 6,759; France 811.
Rails and accessories	1,418	2,822	Algeria 1,110; Austria 953; West Germany 368.
Wire	6,262	5,060	West Germany 1,396; Austria 1,011; France 983.
Tubes, pipes, fittings	126,120	128,348	West Germany 41,020; Netherlands 16,176; U.S.S.R. 11,092.
Castings and forgings, rough	12,144	9,389	France 3,189; West Germany 3,011; Italy 799.
Ingots and semimanufactures, alloy steel and high-carbon steel	43,249	34,404	Italy 11,280; West Germany 10,724; France 7,460.
Lead:			
Oxide	30	23	West Germany 20.
Metal including alloys:			
Scrap	9,443	8,530	Italy 5,306; Austria 1,193; East Germany 987.
Unwrought	3,387	2,796	Italy 1,723; West Germany 570; Netherlands 248.
Semimanufactures	353	88	Belgium-Luxembourg 30; West Germany 20; Italy 16.
Magnesium metal including alloys, all forms	364	313	West Germany 163; United Kingdom 49; Austria 20.
Manganese oxides	63	44	West Germany 28; Sweden 12.
Mercury 76-pound flasks	36	59	Italy 42.
Molybdenum metal including alloys, all forms	2	5	Belgium-Luxembourg 3; West Germany 1.
Nickel:			
Matte, speiss, similar materials	81	66	West Germany 60; Italy 4.
Metal including alloys:			
Scrap	395	179	West Germany 154; United States 13.
Unwrought and semimanufactures	1,836	369	West Germany 146; France 53; United Kingdom 36.
Platinum-group and silver metals including alloys:			
Platinum-group thousand troy ounces	616	1,016	Japan 398; France 162; West Germany 139.
Silver do.	34,966	38,994	Italy 11,664; West Germany 8,634; Austria 4,649.
Tin:			
Oxides kilograms	8,545	--	
Metal including alloys:			
Scrap	79	68	West Germany 50; France 18.
Unwrought	91	84	Italy 40; West Germany 25; France 10.
Semimanufactures	[r]29	34	Austria 13; West Germany 5; Italy 3.

See footnotes at end of table.

Table 2.—Switzerland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Titanium oxides	134	111	West Germany 42; Austria 38; France 20.
Tungsten metal including alloys, all forms	64	23	West Germany 17; United Kingdom 5.
Uranium and thorium oxides, including rare-earth oxides kilograms	1,692	1,922	Austria 409; Italy 282; West Germany 142.
Zinc:			
Oxide	9	51	West Germany 36; France 8; United Kingdom 6.
Metal including alloys:			
Scrap	671	758	Italy 333; France 231; West Germany 157.
Blue powder	17	11	Austria 10.
Unwrought	48	207	West Germany 193; Austria 10.
Semimanufactures	13	9	Austria 2; West Germany 2.
Other:			
Ores and concentrates	64	91	Portugal 45; France 14; West Germany 7.
Ash and residue containing nonferrous metals	24,155	23,457	West Germany 13,093; Italy 4,096; Belgium-Luxembourg 2,624.
Waste and sweepings of precious metals	185	192	West Germany 77; France 64; Belgium-Luxembourg 30.
Oxides, hydroxides, peroxides of metals	187	302	West Germany 175; Italy 65; Yugoslavia 17.
Metals including alloys, all forms:			
Metalloids	4,976	4,532	West Germany 2,923; Japan 673; Hungary 380.
Alkali, alkaline earth, rare-earth metals kilograms	688	515	NA.
Pyrophoric alloys do	207	--	
Base metals including alloys, all forms, n.e.s	61	119	West Germany 58; United States 22; Netherlands 11.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	17	49	Sweden 39; France 1; North Korea 1.
Dust and powder of precious and semiprecious stones kilograms	1,657	1,724	Italy 574; France 317; West Germany 175.
Grinding and polishing wheels and stones	1,008	878	United Kingdom 248; West Germany 159; Algeria 75.
Asbestos	74	37	Austria 19; Belgium-Luxembourg 2; West Germany 2.
Barite and witherite	3	34	West Germany 32.
Boron materials:			
Crude natural borates kilograms	--	102	NA.
Oxide and acid	66	80	West Germany 77; Italy 1.
Cement	20,723	31,519	West Germany 25,868; France 5,231; Austria 145.
Chalk	242	2,029	France 1,882; West Germany 60; Austria 49.
Clays and clay products (including all refractory brick):			
Crude	8,937	20,948	West Germany 16,493; France 4,217; Austria 156.
Products:			
Refractory (including nonclay brick)	790	1,546	West Germany 990; Austria 182; Belgium-Luxembourg 173.
Nonrefractory	47,358	47,146	West Germany 19,199; Austria 11,016; France 8,579.
Cryolite and chiolite	11	4	NA.
Diamond:			
Gem, not set or strung value, thousands	$637,529	$1,015,596	Israel $433,665; United Kingdom $255,162; Belgium-Luxembourg $99,400.
Industrial do	$22,176	NA.	
Diatomite and other infusorial earth	48	51	Yugoslavia 22; France 11; West Germany 5.
Feldspar and fluorspar	509	297	West Germany 246; Peru 67; Iran 35.
Fertilizer materials:			
Crude, phosphatic	5	(1)	All to West Germany.
Manufactured:			
Nitrogenous	216	277	West Germany 101; Austria 67; Belgium-Luxembourg 60.

See footnotes at end of table.

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Table 2.—Switzerland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Fertilizer materials —Continued			
Manufactured —Continued			
Phosphatic	1	4	All to France.
Potassic	28	37	Italy 27.
Other, including mixed	995	1,018	Ecuador 281; Austria 93; West Germany 90.
Ammonia	70	64	France 36; Egypt 4.
Graphite, natural	14	11	West Germany 4; Brazil 3; United States 1.
Gypsum and plasters	934	627	Austria 297; Greece 170; France 69.
Lime	2,466	2,312	West Germany 1,393; France 694; Iraq 199.
Magnesite	10	63	West Germany 24.
Mica:			
Crude, including splittings and waste	66	73	West Germany 38; Austria 13; France 13.
Worked, including agglomerated splittings	461	568	France 94; India 70; United Kingdom 70.
Pigments, mineral:			
Natural, crude	42	31	Peru 17; Austria 6; West Germany 1.
Iron oxides, processed	15	48	Italy 16; West Germany 15; Austria 4.
Precious and semiprecious stones, except diamond:			
Natural value, thousands	$114,248	$165,603	France $31,420; United Kingdom $21,159; West Germany $20,807.
Manufactured thousand carats	^{r}318,310	216,655	West Germany 60,160; Austria 42,200; Italy 30,690.
Salt and brines	1,995	377	France 270; West Germany 91; United States 6.
Sodium and potassium compounds, n.e.s	^{r}31,236	30,299	West Germany 21,307; Austria 8,250.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	^{r}36,439	34,328	West Germany 25,710; Italy 5,560; France 1,673.
Worked	12,811	11,734	West Germany 10,522; Austria 649; Italy 307.
Dolomite, chiefly refractory grade	31	68	Chile 52; Austria 9; West Germany 5.
Gravel and crushed rock	7,964	14,997	West Germany 9,884; France 3,138; Italy 358.
Limestone (except dimension)	15	15	NA.
Quartz and quartzite	38,844	34,139	Italy 31,061; West Germany 2,395.
Sand, excluding metal bearing	8,342	7,851	France 4,282; West Germany 1,922; Italy 1,096.
Sulfur:			
Elemental:			
Other than colloidal	11	13	France 3.
Colloidal	8	10	West Germany 4; United Kingdom 4.
Sulfur dioxide kilograms	28	--	
Sulfuric acid	18,811	14,828	West Germany 11,420; France 1,605; Libya 1,078.
Talc, steatite, soapstone, pyrophyllite	58	71	Austria 40; France 7; Egypt 3.
Other:			
Crude:			
Meerschaum, amber, jet kilograms	8,498	15	NA.
Other	2,210	3,275	Austria 1,530; West Germany 1,075; France 510.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	2,755	23,050	West Germany 23,039; Italy 11.
Slag and ash, n.e.s	19	550	France 539; West Germany 11.
Oxides and hydroxides of magnesium, strontium, barium	28	20	Iran 5; Spain 4; Turkey 2.
Bromine, iodine, fluorine	79	62	United Kingdom 58.
Building materials of asphalt, asbestos, and fiber cement, and unfired non-metals, n.e.s	3,431	4,902	France 1,241; West Germany 959; Austria 886.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	105	60	West Germany 25; Italy 25; Algeria 7.
Carbon black	105	253	Italy 71; West Germany 63; Czechoslovakia 27.
Coal, all grades, including briquets	115	341	Italy 335; France 5.
Coke and semicoke	25	47	West Germany 46.

See footnotes at end of table.

Table 2.—Switzerland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Gas, hydrocarbon, manufactured	63	77	All to France.
Hydrogen, helium, rare gases	55	128	West Germany 45; United Kingdom 24; Jordan 22.
Peat, including peat briquets and litter	1,894	1,937	France 1,223; Austria 670; West Germany 39.
Petroleum refinery products:			
Gasoline, including natural thousand 42-gallon barrels	367	51	All to Austria.
Distillate fuel oil do	26	17	Austria 5; West Germany 4; Italy 2; Saudi Arabia 1.
Residual fuel oil do	246	150	Austria 146; France 4.
Lubricants do	2	1	All to Poland.
Other:			
Liquefied petroleum gas do	319	263	Italy 198; Austria 53; West Germany 8.
Petroleum coke do	(1)	(1)	NA.
Bitumen and other residues and bituminous mixtures, n.e.s do	5	41	West Germany 36; Austria 1.
Mineral jelly and wax do	1	12	Italy 7; Iraq 3.
Unspecified do	(1)	1	NA.
Total do	966	536	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	896	1,419	West Germany 925; United Kingdom 283.

[r] Revised. NA Not available.
[1] Less than 1/2 unit.

Table 3.—Switzerland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate	8,560	7,693	France 5,980; Italy 1,536; West Germany 146.
Oxide and hydroxide	158,096	152,844	Australia 136,954; Surinam 3,231; West Germany 2,211.
Metal including alloys:			
Unwrought	39,219	35,314	Iceland 16,670; Norway 9,014; Austria 3,340.
Semimanufactures	30,739	35,465	West Germany 15,503; Austria 4,010; France 3,660.
Antimony metal including alloys, all forms	137	126	China, Mainland, 80; Belgium-Luxembourg 22; Turkey 21.
Arsenic trioxide, pentoxide, acids	65	--	
Beryllium metal including alloys, all forms kilograms	420	412	United States 339; West Germany 70.
Chromium oxide and hydroxide	499	459	West Germany 300; Italy 77; France 36.
Cobalt oxide and hydroxide	7	16	Belgium-Luxembourg 10; Canada 4; West Germany 2.
Columbium and tantalum: Tantalum metal including alloys, all forms kilograms	681	882	Austria 461; United States 242; West Germany 89.
Copper:			
Ore and concentrate	23	28	All from Austria.
Matte	24,899	21,852	West Germany 6,000; Belgium-Luxembourg 4,265; Austria 3,489.
Copper sulfate	670	854	France 489; U.S.S.R. 149; Belgium-Luxembourg 69.
Metal including alloys:			
Scrap	4,255	4,952	West Germany 2,824; France 1,116; United Kingdom 387.
Unwrought	1,799	1,359	West Germany 709; United Kingdom 82; Yugoslavia 47.
Semimanufactures	54,661	63,032	West Germany 21,674; United Kingdom 19,093; Belgium-Luxembourg 6,373.

See footnotes at end of table.

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Table 3.—Switzerland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Gold metal, unworked or partly worked troy ounces	136,480	41,603	West Germany 17,651; United Kingdom 8,006; France 5,594.
Iron and steel:			
Ore and concentrate, including roasted pyrite	31,406	59,552	Mauritania 38,294; West Germany 16,688; Italy 4,516.
Metal:			
Scrap	57,751	87,236	West Germany 73,135; Netherlands 4,868; Yugoslavia 2,710.
Pig iron and similar materials	83,808	83,591	West Germany 40,041; Norway 13,309; France 11,056.
Ferroalloys	18,429	18,772	Norway 4,365; West Germany 3,789; France 2,509.
Steel, primary forms	82,709	66,984	Italy 15,933; West Germany 15,092; Belgium-Luxembourg 14,300.
Semimanufactures:			
Bars, rods, angles, shapes, sections	^{r}404,437	410,706	West Germany 130,958; Italy 104,122; France 73,111.
Universals, plates, sheets	536,553	508,793	France 115,287; West Germany 106,459; Japan 70,039.
Hoop and strip	169,041	171,467	Belgium-Luxembourg 58,025; West Germany 54,638; Austria 16,540.
Rails and accessories	39,791	47,768	Austria 28,405; West Germany 11,680; Italy 4,296.
Wire	18,254	21,851	West Germany 7,507; Austria 7,367; Belgium-Luxembourg 2,040.
Tubes, pipes, fittings	^{r}126,775	140,270	West Germany 54,778; France 27,550; Italy 23,352.
Castings and forgings, rough	5,411	6,647	West Germany 3,710; Romania 851; Austria 777.
Ingots and semimanufactures, alloy steel and high-carbon steel	157,620	164,719	West Germany 64,376; United Kingdom 26,160; France 20,342.
Lead:			
Ore and concentrate	10	--	
Oxides	153	174	Mexico 123; United Kingdom 35; West Germany 12.
Metal including alloys:			
Scrap	36	71	France 58; West Germany 7; Austria 4.
Unwrought	14,477	15,048	France 6,034; United Kingdom 4,102; Canada 2,315.
Semimanufactures	^{r}1,418	1,469	West Germany 1,372; Belgium-Luxembourg 69; Italy 13.
Magnesium metal including alloys, all forms	1,819	1,673	Norway 1,146; Canada 177; Italy 161.
Manganese oxides	841	513	Greece 209; Japan 123; West Germany 95.
Mercury 76-pound flasks	713	702	West Germany 303; United States 266.
Molybdenum metal including alloys, all forms	19	17	Austria 7; West Germany 4; United States 3.
Nickel:			
Matte, speiss, similar materials	1,336	1,460	United Kingdom 305; Canada 279; Republic of South Africa 183.
Metal including alloys:			
Scrap	204	60	France 20; Italy 19; Canada 9.
Unwrought and semimanufactures	1,693	1,283	West Germany 454; United Kingdom 360; United States 209.
Platinum-group and silver metals including alloys:			
Platinum-group thousand troy ounces	^{r}662	709	Netherlands 174; France 172; West Germany 134.
Silver do	38,596	36,933	United Kingdom 13,793; India 4,761; Mexico 3,872.
Tin:			
Oxides	5	--	
Metal including alloys:			
Scrap	10	6	Sweden 4; France 2.
Unwrought	705	932	Indonesia 370; Malaysia 155; Thailand 117.
Semimanufactures	226	249	West Germany 117; Netherlands 71; France 25.
Titanium oxides	7,763	7,194	France 2,408; West Germay 2,085; Netherlands 646.

See footnotes at end of table.

Table 3.—Switzerland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Tungsten metal including alloys, all forms	70	89	West Germany 60; France 13; United Kingdom 9.
Uranium and thorium oxides, including rare-earth oxides	13	15	France 8; Austria 3; West Germany 2.
Zinc:			
Ore and concentrate ___ kilograms__	347	7,578	All from West Germany.
Oxide	2,442	2,515	France 1,093; West Germany 595; United Kingdom 425.
Metal including alloys:			
Scrap	24	59	Belgium-Luxembourg 40; United Kingdom 19.
Blue powder	2,031	2,160	Belgium-Luxembourg 1,099; Netherlands 356; France 240.
Unwrought	26,696	25,855	West Germany 7,132; France 3,252; United Kingdom 2,799.
Semimanufactures	1,257	1,193	West Germany 517; Belgium-Luxembourg 376; Italy 96.
Other:			
Ores and concentrates	7,462	6,089	Republic of South Africa 3,791; Australia 1,481; Italy 190.
Ash and residue containing nonferrous metals	295	164	West Germany 89; Austria 71; Belgium-Luxembourg 3.
Oxides, hydroxides, peroxides of metals	1,093	1,358	West Germany 1,058; Belgium-Luxembourg 86; United States 69.
Metals including alloys, all forms:			
Metalloids	3,295	3,855	Netherlands 1,085; France 1,048; Italy 900.
Alkali, alkaline earth, rare-earth metals	431	502	West Germany 467; United States 28; France 5.
Pyrophoric alloys	13	--	
Base metals including alloys, all forms, n.e.s	576	917	United States 287; Japan 148; France 85.
Waste and sweepings of precious metals	86	63	West Germany 14; Italy 12; France 10.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	1,077	1,080	West Germany 465; Italy 370; United States 162.
Dust and powder of precious and semiprecious stones_____ kilograms__	2,354	2,401	Ireland 1,577; United States 444; United Kingdom 165.
Grinding and polishing wheels and stones	1,582	2,017	West Germany 941; Italy 279; Austria 239.
Asbestos	22,682	22,794	Canada 9,111; Republic of South Africa 5,611; U.S.S.R. 4,432.
Barite and witherite	3,324	2,880	West Germany 1,857; France 963; Italy 60.
Boron materials:			
Crude natural borates	4,358	7,297	United States 7,051; Netherlands 124; Turkey 50.
Oxide and acid	648	594	France 325; United States 107; West Germany 57.
Cement	99,780	146,174	Italy 87,100; West Germany 28,053; France 27,000.
Chalk	21,460	25,192	France 21,464; West Germany 1,695; Italy 1,611.
Clays and clay products (including all refractory brick):			
Crude	185,432	178,261	West Germany 60,941; United Kingdom 54,419; France 24,812.
Products:			
Refractory (including nonclay brick)	28,594	33,638	West Germany 11,157; Austria 5,391; France 4,088.
Nonrefractory	182,814	227,159	Italy 125,837; West Germany 67,694; France 21,814.
Cryolite and chiolite	445	845	Denmark 835; United Kingdom 10.
Diamond:			
Gem, not set or strung value, thousands__	$695,515	$1,141,973	United Kingdom $820,798; Belgium-Luxembourg $81,569; U.S.S.R. $49,477.

See footnotes at end of table.

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Table 3.—Switzerland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Diamond —Continued			
Industrial ---- value, thousands	$24,403	NA.	
Diatomite and other infusorial earth	6,207	8,098	Denmark 4,909; France 1,539; West Germany 436.
Feldspar and fluorspar	14,784	10,065	West Germany 3,236; Italy 2,850; France 2,813.
Fertilizer materials:			
Crude:			
Nitrogenous	160	109	West Germany 72; Belgium-Luxembourg 10.
Phosphatic	10,393	11,393	Morocco 10,464; Netherlands 549; France 320.
Potassic	80,314	84,004	France 69,763; West Germany 9,410; East Germany 4,830.
Manufactured:			
Nitrogenous	63,052	72,179	West Germany 28,142; Austria 24,965; Italy 6,885.
Phosphatic:			
Thomas (basic) slag	144,444	146,786	France 96,831; Belgium-Luxembourg 49,707; West Germany 248.
Other	9,373	8,940	United States 2,619; France 2,377; Tunisia 1,797.
Potassic	73,381	77,577	France 63,335; West Germany 9,410; East Germany 830.
Other, including mixed	87,320	99,036	France 47,447; West Germany 22,398; Belgium-Luxembourg 9,469.
Ammonia	18,696	20,266	Austria 15,045; France 4,932; Italy 224.
Graphite, natural	174	190	West Germany 103; Austria 36; Italy 22.
Gypsum and plasters	56,167	52,454	West Germany 34,309; France 9,722; Italy 8,333.
Lime	31,788	39,508	Italy 22,185; West Germany 17,045; Austria 155.
Magnesite	3,018	4,310	Austria 3,470; France 268; Spain 198.
Mica:			
Crude, including splittings and waste	544	638	West Germany 301; India 122; Norway 72.
Worked, including agglomerated splittings	310	654	France 394; Belgium-Luxembourg 179; Austria 64.
Pigments, mineral:			
Natural, crude	310	359	West Germany 169; Austria 134; France 45.
Iron oxides, processed	3,069	2,780	West Germany 2,614; United Kingdom 68; Belgium-Luxembourg 25.
Precious and semiprecious stones, except diamond:			
Natural ----- value, thousands	$154,032	$184,929	United Kingdom $21,702; West Germany $20,688; France $18,287.
Manufactured --- thousand carats	89,605	76,655	France 70,890; United Kingdom 1,330; United States 1,160.
Pyrite, gross weight	24,110	164	Italy 125; West Germany 39.
Salt and brines	1,735	1,840	France 1,482; West Germany 174; Belgium-Luxembourg 92.
Sodium and potassium compounds, n.e.s	13,863	15,265	France 5,267; Italy 5,213; West Germany 3,712.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	129,774	141,653	West Germany 76,962; Austria 31,012; Italy 20,305.
Worked	67,738	73,234	Italy 58,321; Austria 5,537; West Germany 3,439.
Dolomite, chiefly refractory grade	16,267	21,924	Italy 16,713; France 3,701; Austria 584.
Gravel and crushed rock thousand tons	4,083	4,261	France 2,174; West Germany 1,113; Italy 715.
Limestone (except dimension)	7,234	6,714	France 6,474; West Germany 147.
Quartz and quartzite	13,836	18,605	Italy 10,993; West Germany 5,612; Greece 1,417.
Sand, excluding metal bearing thousand tons	1,146	1,154	Italy 582; France 270; West Germany 162.
Sulfur:			
Elemental:			
Other than colloidal	44,859	46,656	West Germany 44,377; France 2,226.
Colloidal	287	213	France 131; West Germany 80; Japan 1.
Sulfur dioxide	38	--	
Sulfuric acid	1,448	2,538	West Germany 1,378; Italy 967; Austria 154.
Talc, steatite, soapstone, pyrophyllite	11,042	10,766	Austria 6,464; France 1,678; Italy 1,374.

See footnotes at end of table.

Table 3.—Switzerland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Other:			
Crude:			
Meerschaum, amber, jet kilograms	9,607	18,135	NA.
Other	61,271	76,742	West Germany 35,342; Italy 15,254; France 12,996.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	6,481	4,717	West Germany 2,707; France 1,960.
Slag and ash, n.e.s	18,807	18,807	West Germany 13,521; France 4,806; Italy 426.
Oxides and hydroxides of magnesium, strontium, barium	605	290	France 131; West Germany 65; United States 23.
Bromine, iodine, fluorine	3,019	3,284	Israel 1,196; France 1,101; United States 563.
Building materials of asphalt, asbestos, and fiber cement, and unfired metals, n.e.s	18,272	19,805	West Germany 11,504; Austria 4,178; France 1,402.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,113	1,731	Trinidad and Tobago 1,545; United States 108; West Germany 45.
Carbon black and gas carbon:			
Carbon black	6,472	4,479	West Germany 2,739; Netherlands 478; Italy 462.
Gas carbon	15	75	West Germany 75.
Coal, all grades, including briquets	196,379	190,679	West Germany 122,304; Republic of South Africa 22,748; Czechoslovakia 14,222.
Coke and semicoke	118,812	121,452	West Germany 80,489; France 28,349; Netherlands 7,193.
Gas, hydrocarbon, manufactured kilograms	213	65	France 45.
Hydrogen, helium, rare gases	2,281	3,284	West Germany 2,804; Italy 381; France 41.
Peat, including peat briquets and litter	69,698	77,734	West Germany 60,633; U.S.S.R. 16,075; France 643.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	31,059	29,020	United Arab Emirates 9,724; Libya 7,102; Nigeria 3,980.
Refinery products:			
Gasoline (including natural) do	16,025	16,252	Italy 4,577; France 4,339; Belgium-Luxembourg 3,749.
Distillate fuel oil do	6,847	6,668	U.S.S.R. 2,578; Italy 1,185; France 968.
Residual fuel oil do	38,430	41,202	U.S.S.R. 16,199; France 9,589; Netherlands 4,380.
Lubricants do	7	7	West Germany 2; Austria 1; Belgium-Luxembourg 1.
Other:			
Liquefied petroleum gas do	7,177	8,139	Netherlands 6,401; West Germany 1,710; Czechoslovakia 11.
Petroleum coke do	244	331	United States 207; West Germany 120; Italy 4.
Mineral jelly and wax do	95	109	West Germany 69; France 12; Italy 8.
Bitumen and other residues and bituminous mixtures, n.e.s do	969	1,198	France 760; Italy 248; West Germany 170.
White spirit do	123	130	France 58; Netherlands 50; West Germany 10.
Total do	69,917	74,036	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	31,283	26,963	France 10,048; Netherlands 5,598; West Germany 5,288.

rRevised. NA Not available.

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COMMODITY REVIEW

METALS

Aluminum.—Three plants, with a total annual capacity of 88,000 tons, were in operation during 1978-79. Two of them, Chippis (30,000 tons per year) and Steg (48,000 tons per year) in Valais, were operated by Swiss Aluminium Ltd. The third one, at Martigny (10,000 tons per year), was operated by Usine d'Aluminium Martigny SA. All of them processed imported alumina.

Iron and Steel.—During 1978-79, the steel industry of Switzerland differed from most steel industries operating in Europe because of its modest size and narrow range of products it delivers. Reinforcing bars continued to be the major product of the industry, making the sector sensitive to variations of construction activities in the country and abroad. In addition, a number of rolling facilities produced semimanufactured steel products. Four companies, Monteforno Acciaierie e Laminatoi SA, Von Moos Stahl AG, Von Roll Ltd., and Ferrowohlen AG (with aggregate capacity of 700,000 tons per year), produced steel during the period.

NONMETALS

Cement.—Cement continued to be the most important nonmetal produced in Switzerland. Except for energy, all other materials required for production of cement were produced in the country. Reserves of raw materials are ample. During 1978-79, 14 plants were in operation with a total capacity of 6.6 million tons, but the industry operated at about 55% of capacity. Most installations were rotary dry kilns. Fuel oil was the chief fuel used, and about 1,500 persons were employed in the country's cement industry. The largest producer was Portland Cement Werk Wuerenlingen Siggenthal AG with its 1-million-ton-per-year plant at Siggenthal.

Other Nonmetals.—Output of other nonmetals was of domestic significance only. Table 1 shows details of production.

MINERAL FUELS

Imported primary energy carriers were the major sources of energy in Switzerland during 1978-79. Domestic output was limited to hydropower and noncommercial fuels. During past years, apparent energy consumption ranged between 23 and 25 million tons of standard coal equivalent (SCE).[2] Petroleum was, by far, the major energy source and accounted for about 79% of total consumption; hydropower, the only domestic commercial source, contributed about 13% of the total. Imported natural gas contributed 4%, coal, also imported, 1%, and nuclear power 3%.

Petroleum and Natural Gas.—There was no oil or natural gas production in Switzerland during 1978-79. Exploration, however, which started in 1974, continued in pre-Alpine and Jura regions. About 150 kilometers of seismic profiles were completed in the eastern cantons (Zurich, Aargau, Zug, Schwyz) for SA pour le Petrole Suisse, Zurich. The Jura Bernois Petrole SA completed 81 kilometers of geophysical profiles and about 120 meters of shallow holes in the same area. Results of two wells drilled for stocking imported natural gas led to an indication of possible natural gas and crude oil occurrences. One well on the Fribourg Sud concession was dry and was abandoned at 4,022 meters. BEAG and Bochumer Mineralöl GmbH (BOMIN) were the investors. At yearend, drilling was underway on one location near Treycovagnes, south of Yverdon. No details on depth or results were made public. The operator was Consortium de Jura Vaudois Petrole SA.

Three petroleum refineries, La Raffinerie du Sud-Ouest SA at Collombey, La Raffinerie de Cressier SA, and La Raffinerie Rheintal AG, produced about 4.6 million tons of petroleum refinery products, or about 34% of total demand.

In 1979, crude oil was imported, mostly from the United Arab Emirates 46%, Iran 16%, Nigeria 14%, Algeria 10%, Libya 8%, and Saudi Arabia 6%. East European countries 29%, France 22%, and Italy 16% were the major suppliers of petroleum products.

Uranium.—Nuclear powerplants and the need for nuclear power were closely examined by the Government and various groups of citizens during 1978. As a result, a Federal referendum was held in February 1979 in which voters decided to approve further development of nuclear power.

Three nuclear powerplants were operational in 1978-79, and four were in various stages of construction. If all are completed, installed capacity of nuclear powerplants in Switzerland should reach 4,500 megawatts electric.

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[1] Physical scientist, Branch of Foreign Data.

[2] 1 ton of SCE = 7,000,000 kilocalories.

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The Mineral Industry of Taiwan

By E. Chin[1]

The gross national product (GNP) of Taiwan for 1979 was estimated at $30.1 billion[2] at current prices and at $13.8 billion at 1971 prices, compared with $24.7 billion and $12.8 billion, respectively, for 1978.[3] The average annual growth rate in GNP during the last two decades was 9% in absolute terms, while the growth in 1978 over the previous year was 7.8%. The net domestic product (NDP) in 1978 was $18.9 billion in current prices. By sectors the largest inputs to the NDP were manufacturing, 30.5%; agriculture, forestry, fishery, and livestock, 12.0%; Government services, 12.4%; commerce, 11.5%; real estate, 6.2%; transportation and communications, 6.3%; construction, 6.0%; and banking 5.6%. The mining sector accounted for only 0.9% in 1977, compared with 1.5% in 1970.

Owing to strong export demand for domestically produced goods, Taiwan's industrial production index grew by 25% in 1978. Manufacturing (the largest component of the index), construction, and public utilities were the major sectors showing vigorous growth. The indexes of industrial production for minerals-related components of the economy (1971 = 100) are given in the following table:

Sector	1976	1977	1978
Mining:			
Coal	80.8	73.8	72.0
Metal	263.7	255.0	319.7
Nonmetal	260.8	333.8	349.0
Salt evaporation	71.6	73.6	49.8
Crude petroleum and natural gas	170.6	176.0	171.0
Chemicals and petroleum refining:			
Acids and alkalis	101.8	109.1	122.1
Fertilizer	161.4	167.5	203.7
Petroleum refining	189.5	212.8	251.3
Petroleum products	406.6	503.8	638.5
Coke	89.9	90.1	93.9
Nonmetallic mineral products:			
Structural clay products	117.3	127.5	133.7
Cement	165.7	195.4	216.7
Cement products	88.2	78.0	78.8
Basic metals:			
Ferrous	147.9	172.5	285.6
Nonferrous	107.5	121.8	184.2
Metal products:			
Ferrous	139.3	169.0	220.0
Aluminum	143.9	168.1	215.9
Other	193.9	207.4	215.5
Overall industrial production: General index	187.9	209.9	262.3

Taiwan has small coal mines, small to medium-sized quarries, and medium to large industrial plants. Taiwan is deficient in minerals, except construction raw materials. Ranked by value, fuels (primarily coal with some crude petroleum and natural gas), dolomite, and limestone (including marble) were the leading mineral products mined in Taiwan. However, output of each of these minerals was not significant in terms of world market. Other economically important minerals that are mined locally include copper, gold, salt, sulfur, and talc. However, the value of Taiwan's processing activities of imported minerals and metals overshadows the value of indigenous extraction. In 1978, the mineral-processing sector outweighed the domestic mining sector 27 to 1 in output value compared with a 22-to-1 ratio in 1977. A breakdown by value of output for mineral-related sectors, in million Taiwan dollars, follows:

Sector	1976	1977	1978
Mining:			
Coal	4,388	4,043	4,072
Crude petroleum and natural gas	4,420	4,472	4,331
Metal	1,022	912	956
Nonmetal	1,208	1,469	1,653
Salt evaporation	261	265	179
Total	11,299	11,161	11,191
Manufacturing:			
Chemical products	99,151	116,375	129,296
Petroleum and coal products	55,546	66,280	77,416
Basic metals	23,324	28,137	51,970
Metal products	6,665	8,088	10,903
Nonmetallic mineral products	20,328	23,969	27,992
Total	205,014	242,849	297,906

On the basis of a monthly average, the number of persons employed by the mining and quarrying sector in 1978 was 45,585 compared with manufacturing, 1,247,092; transportation and communications, 286,778; construction, 188,699; and services, 144,817. The average monthly working days for employees in mining and quarrying was 22.3, lower than the other major industrial sectors, which ranged between 23.7 and 27.8 days. Employees of the electricity, gas, and water utilities had the highest average monthly earnings, $261, followed by mining and quarrying, $214; transportation and communications, $201; construction, $180; manufacturing, $178; and services, $119.

During the 1969-78 period, Taiwan's total supply of energy increased at an average annual rate of 11.0%. The largest growth during the decade was from the imports of coal (27.2%), crude oil (18.0%), and petroleum products (10.2%). In 1978, the island's total supply of energy was estimated at 29.2 million kiloliters expressed in oil equivalent. Production of domestic fuels accounted for 19% of the total and, by sector, was as follows in percent: Coal, 37%; natural gas, 35%; hydroelectric power, 24%; and crude oil, 4%. Imports provided 81% of the total energy supply and were distributed as follows in percent: Crude oil, 84%; petroleum products, 9%; coal, 4%; and nuclear, 3%. The configuration of demand for commercial energy was as follows in million kiloliters of oil equivalent: Hydroelectric power, 1.3; thermal electric, 7.6; coal and coal products, 2.4; petroleum products, 13.3; natural gas, 1.9; nuclear, 0.7; and exports, 1.9.

Taiwan's industrial consumption of energy increased by 16% in 1978. The estimated breakdown of consumption, expressed in electrical energy equivalent and detailed by the minerals-related industries, was as follows in million kilowatt-hours:

Sector	1976	1977	1978
Mining and quarrying	364	382	409
Basic industrial chemicals	1,236	1,222	1,404
Chemical fertilizers	472	520	399
Other chemical products	2,519	2,894	3,303
Cement	1,127	1,311	1,404
Iron and steel	1,726	1,966	2,442
Aluminum	334	517	881
Metal products	523	591	711
Other industries	10,057	10,998	12,646
Total	18,358	20,401	23,601

On September 6, 1979, the Government of Taiwan announced the extension of the limits of its territorial waters from 3 to 12 nautical miles. Additionally its economic zone would extend to a distance of 200 nautical miles and any conflicts on overlapping zones would be negotiated with the Governments respectively concerned to determine boundaries under the principles of international law.

In 1974, the Government announced the Ten Major Development Projects, designed

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to spur the domestic economy, to lay a foundation for future growth, and to bring Taiwan into the world ranking of industrial and modern countries. The projects, to be completed within 5 years, included six in the transportation sector, three in the heavy and chemical industries, and one in the energy sector. By the end of 1979, five projects were completed and substantial progress had been made on the other five The North-South Freeway, connecting Keelung and Fengshan and with two sections linking Taoyuan and Hsiaokang International Airports, was completed on October 31, 1978. The total length of the freeway runs 373 kilometers, and cost of construction was NT$45 billion. The first of the 10 projects to be completed was the Kaohsiung Shipyard in June 1976. (The shipyard of the China Shipbuilding Corporation is also located in the Kaohsiung Coastal Industrial District, next to the integrated steel mill near the second harbor of Kaohsiung.) Kaohsiung Shipyard has an annual shipbuilding capacity of 1.5 million metric tons and a repair capacity of 2.5 million metric tons. Since its completion, two 445,000-ton tankers have been launched and delivered.

The first-stage construction of Taichung Harbor was completed and opened to traffic in October 1976 at a cost of NT$5.7 billion. Construction on the second stage is currently in progress. Also, first-stage construction of the integrated steel mill of the China Steel Corporation was completed at the end of 1977, and construction on the second stage is due to be completed in 1982. First-stage construction on the first of three nuclear powerplants was completed in November 1977 when the first generator (636,000-kilowatt capacity) began operation. Installation of the second generator was completed in 1979. With the exception of one downstream project, all components facilities of the petrochemical complex have been completed and put into operation.

Construction status on the remaining four projects were as follows: The $281 million Chiang Kai-shek International Airport at Taoyuan was opened in March 1979. Construction of the first-stage plan for Suao Harbor was scheduled for completion in June 1979. By August, the railway between Keelung and Kaohsiung was fully electrified at a cost of $603 million. Finally, the North-Link Railway was completed at the end of 1979, at a total investment of $140 million.

In 1977, the Government subsequently proposed 12 additional projects, almost all of which are a continuation of the 10 previous projects. These included further expansion of the railroad, highways, integrated steel mill, harbor, nuclear powerplants, and agricultural mechanization. However, the planned extension of the North-South Freeway designed to link Kaohsiung with Pingtung was suspended. Additionally, Government owned enterprises such as the Chinese Petroleum Corporation, Tang Eng Iron Works, and Taiwan Machinery Manufacturing Company were also to invest substantially in large-scale facilities to manufacture heavy industry products.[4]

In early 1979, formal diplomatic relations between the United States and Taiwan were severed. Communications were conducted through nongovernmental organizations: American Institute in Taiwan and the Coordinating Council for North American Affairs. Despite the change, the United States remained as Taiwan's largest export market and its primary supplier of technology and investment capital.

PRODUCTION

Coal was the most important mineral commodity mined in Taiwan. Output of bituminous coal, however, has decreased annually since 1967. Domestic crude petroleum production is negligible. The principal significance of indigenous oil was as a very small supplement to imported crude oil in the production of refinery products. Natural gas output likewise is of little consequence by world standards.

The overall value of production by the mining industry was estimated at $313 million and was distributed as follows, in million dollars: Coal, $113; crude petroleum and natural gas, $124; metals, $26; evaporated salt, $5; and miscellaneous nonmetallic mining and quarrying, $46. In comparison, the value-added output by secondary and tertiary industries related to minerals and metals was as follows in million dollars: Chemicals and chemical products, $3,587; petroleum and coal products, $2,147; nonmetallic mineral products, $774; and basic metals and metal products, $1,745.

In addition to coal, the only minerals domestically mined of significant quantity include salt, dolomite, limestone, marble, clays, and talc soapstone.[5] Amounts of metal ores are produced domestically, notably copper, iron, gold, and silver. In addition to byproduct sulfur, local production of other nonmetallic values includes gypsum, serpentine, asbestos, talc, feldspar, mica, and sands.

The bulk of Taiwan's industrial output of minerals-derived products is from imported materials. Domestic production of finished articles and semimanufactures is for export markets as well as internal consumption. Metal production includes ingot and manufactures of iron and steel, aluminum, copper, gold, and silver. In addition, there is significant output of derivative materials from nonmetallic mineral and petroleum refining, including mineral acids and alkalis, chemical fertilizers, chemicals and pharmaceuticals, organic solvents and fuels, refractory bricks, and cement. In 1978, the output value of the mineral-processing sector was estimated at $8.3 billion.

Table 1.—Taiwan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Alumina, gross weight	47,700	51,074	[e]51,300	60,000
Metal, primary	25,512	29,740	50,512	[e]56,218
Sheet	18,617	20,740	25,421	[e]26,001
Copper:				
Mine output, metal content	2,000	2,000	800	900
Metal:				
Smelter, secondary	11,700	11,500	13,000	14,000
Refined, secondary	11,660	11,511	14,541	13,700
Gold metal, primary troy ounces	26,952	14,995	13,407	15,000
Iron and steel:				
Iron ore	--	32,427	[e]32,000	--
Pig iron	104,829	72,425	249,384	[e]324,000
Ferroalloys (ferrosilicon)	23,342	24,672	29,785	34,000
Crude steel	634,485	910,480	1,268,822	[e]1,570,185
Lead metal, smelter, secondary	11,700	11,500	14,500	13,700
Silver metal, primary	99,969	67,905	75,316	75,000
NONMETALS				
Asbestos	853	673	2,031	2,000
Cement, hydraulic thousand tons	8,749	10,320	11,461	[e]11,897
Clays:				
Kaolin	27,484	29,230	66,180	85,041
Fire clay	12,972	23,477	24,889	48,528
Feldspar	12,567	16,219	15,757	[e]24,288
Gypsum:				
Precipitated	1,578	2,325	1,526	1,600
Other	720	5,087	1,859	2,000
Lime thousand tons	164	159	193	190
Mica	448	1,334	1,388	1,100
Nitrogen: N content of ammonia	319,619	325,485	438,605	465,000
Pyrite and pyrrhotite (including cuprous), gross weight[3]	9,386	7,304	[e]7,500	6,800
Salt, marine thousand tons	497	496	341	307
Sodium and potassium compounds:				
Caustic soda	[r]267,096	301,047	362,180	419,545
Sodium carbonate (soda ash)	74,358	74,625	71,820	71,800
Stone:				
Dolomite thousand tons	172	284	417	[e]500
Limestone do.	9,612	11,679	12,857	[e]13,125
Marble thousand cubic meters	1,245	1,620	1,641	[e]1,976
Serpentine	12,972	23,477	24,889	[e]48,589
Sulfur:				
Native, elemental	5,000	8,200	[e]5,100	9,500
Content of pyrite	3,600	2,800	[e]2,900	2,500
Byproduct, all sources[4]	2,000	2,000	2,000	2,000
Total	10,600	13,000	10,000	14,000
Talc and related materials: Soapstone	15,481	10,160	9,946	9,100

See footnotes at end of table.

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Table 1.—Taiwan: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	[r] [e]2,200	2,500	9,501	9,500
Coal, bituminous thousand tons	3,236	2,156	2,884	[2]2,720
Coke	228	229	236	[2]240
Gas, natural:[4]				
Gross million cubic feet	64,824	66,609	64,999	[2]60,759
Marketed do	[e]63,500	64,950	[e]63,400	59,000
Natural gas liquids:				
Liquefied petroleum gas (from natural gas) thousand 42-gallon barrels	[e]600	[e]700	731	750
Natural gasoline do	[e]500	[e]1,000	884	900
Petroleum:				
Crude do	1,555	1,597	1,552	[3]1,451
Refinery products:				
Gasoline do	8,500	9,778	11,383	[2]12,560
Kerosine do	918	320	--	[2]79
Distillate fuel oil do	15,189	16,262	20,533	[2]20,643
Residual fuel oil do	43,067	48,573	58,264	[2]57,525
Other:				
Lubricants do	[r]657	760	917	[2]945
Asphalt do	1,679	2,308	2,420	[2]1,715
Other[5] do	[r]4,364	4,374	7,905	[2]5,304
Refinery fuel, losses, and not reported[6] do	[r]5,587	10,378	7,965	7,760
Total do	79,961	92,753	109,387	106,531

[e] Estimate. [p] Preliminary. [r] Revised.

[1] In addition to the commodities listed, iron, lead, tin, and zinc may also be produced, but information is not available.

[2] Reported figure.

[3] From Chinkuashih only.

[4] Largely processed into natural gas liquids.

[5] Naphtha, solvent oil, and base oil.

[6] Includes liquefied petroleum gas and jet fuel.

TRADE

Taiwan's two-way trade in 1978 totaled $24.3 billion, up 36% from that in 1977. Total trade in 1979 was estimated at $30.6 billion. Exports increased from $9.3 billion in 1977 to $13.0 billion in 1978, and to $15.9 billion in 1979. Similarly, imports increased from $8.5 billion in 1977 to $11.3 billion in 1978 and to $14.7 billion in 1979. The largest import categories during 1978 were as follows in million dollars: Basic metals and metal products, $4,699 (includes iron and steel, $798, and nonferrous metals, $292); minerals, $5,858 (includes crude petroleum, $1,631); agricultural, forest, and food products, $1,506; chemical and pharmaceutical products, $1,341 (includes chemical compounds, $609, and chemical fertilizers, $48); textiles and related products, $834; and nonmetallic mineral products, $289 (includes refined petroleum products, $208).

Textiles, leather, wood, and related products constituted 34% of total exports, or $4,443 million, in 1978. Exports of basic metals and metal products totaled $3,885 million, the major share of which was electrical machinery and apparatus, $2,059 million. In this category, exports of iron and steel and nonferrous metals were, respectively, only $294,000 and $35,000, illustrating Taiwan's ability to export value-added manufactures. The other leading export categories included agricultural and food products, $978 million; nonmetallic mineral products, $494 million (included $261 million for refined petroleum products, $41 million for cement, and $60 million for glass and glass products); and chemical and pharmaceutical products, $282 million. Exports of minerals were small and were valued at only $4 million.

By value, imports from Japan accounted for 31% of Taiwan's total imports, followed by the United States, 22%; Kuwait, 7%; Saudi Arabia, 6%; and West Germany, 4%. Receipts from Malaysia and Singapore, Australia, and the United Kingdom were each around 2% to 3% of all imports. The remainder of the imports was contributed by a host of countries.

Taiwan's major export destinations were the United States, 40% by value of total shipments in 1978; Japan, 12%; Hong Kong, 7%; and West Germany, 5%. Receipts by Malaysia and Singapore, United Kingdom, Canada, Saudia Arabia, and Australia each ranged between 2% and 3% of the value of total shipments during the year.

Taiwan is dependent on imported raw materials to meet the demands of its export-oriented industries. Petroleum is the single largest import item. Moreover, the country's foreign trade is highly concentrated in two countries, Japan and the United States, which together represent about 50% by value of both imports and exports. To counterbalance currency revaluations, higher fuel costs, and other factors that would adversely affect the economy, Taiwan was attempting to diversify export markets and overseas supply sources. The Government abolished restrictions on many trade items in a move to reduce inflationary pressures on the economy due to higher import prices. During 1978, the Government moved toward easing trade restrictions; most liberalizations became effective on July 14, 1978. The item changes relating to the minerals industries were as follows:

Category	Number of commodities	Imports			Exports	
		Permissible	Controlled	Prohibited	Permissible	Controlled
1977:						
Minerals	465	457	8	--	267	[illegible]
Nonmetal mineral products	657	655	1	1	622	[illegible]
Chemicals	1,900	1,790	101	9	1,778	[illegible]
Basic metals	1,794	1,790	4	--	1,594	[illegible]
Metallic products	2,677	2,653	24	--	2,655	[illegible]
1978:						
Minerals	446	446	--	--	419	[illegible]
Nonmetal mineral products	676	674	1	1	642	[illegible]
Chemicals	2,178	2,077	92	9	2,088	[illegible]
Basic metals	1,551	1,545	--	--	1,359	[illegible]
Metallic products	3,078	3,045	--	--	3,052	[illegible]

Minerals-related goods to be admitted duty-free included unroasted pyrite; sulfur (other than sublimed, precipitated, or colloidal); natural calcium phosphate, aluminum-calcium phosphate, apatite, and phosphate chalk; potassic mineral or chemical fertilizers; and copper matte and native copper. Items with reduced tariffs included natural graphite (from a duty rate of 13% to 7.5% ad valorem); artificial and colloidal graphite (20% to 15%); natural cryolite (7% to 2.5%); stainless steel plate and sheet (16% to NT$9,000 per ton); and stainless steel forged rod (16% to NT$8,400 per ton). Moreover, the Executive Yuan lifted customs duties on pollution control equipment and measuring and testing instruments which the country was not able to produce locally.

Table 2.—Taiwan: Exports and reexports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Oxide and hydroxide	3,964	2,380	NA.
Metal including alloys, all forms	3,741	8,271	Japan 2,779; Hong Kong 1,450; Saudi Arabia 234.
Copper:			
Copper sulfate	66	22	NA.
Metal including alloys:			
Scrap	3,261	5,518	Mainly to Japan.
Unwrought	536	428	NA.
Semimanufactures	2,875	5,020	Japan 1,762; Hong Kong 1,292; Singapore
Iron and steel metal:			
Scrap	35,836	156,420	Japan 87,559; Thailand 55,253; Philippines 6,100.
Pig iron, ferroalloys, similar materials	18,518	20,082	Japan 15,031; Indonesia 1,609.
Steel, primary forms	15,215	187,531	NA.

See footnotes at end of table.

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Table 2.—Taiwan: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Iron and steel metal —Continued			
Semimanufactures:			
Bars, rods, angles, shapes, sections:			
Wire rod and other bars and rods	112,506	359,947	NA.
Angles, shapes, sections	21,454	42,086	NA.
Universals, plates, sheets	27,354	138,800	United States 89,813; Japan 24,881.
Hoop and strip	7,295	4,231	Indonesia 1,855; Singapore 875; United States 303.
Rails and accessories	6,711	2,241	Singapore 1,234; Indonesia 527.
Wire	1,977	11,561	Singapore 2,287; Saudi Arabia 1,285; Japan 857.
Tubes, pipes, fittings	113,383	150,801	United States 97,315; Saudi Arabia 11,534.
Castings and forgings, rough	9,553	11,925	NA.
Lead metal including alloys, all forms	1,802	5,584	Japan 4,450; Republic of Korea 322; Thailand 306.
Magnesium metal including alloys, all forms	274	270	United States 270.
Manganese oxides	--	5	All to Japan.
Mercury 76-pound flasks	(2)	--	
Nickel:			
Matte, speiss, similar materials	151	146	NA.
Metal including alloys:			
Scrap	372	349	NA.
Unwrought and semimanufactures	74	38	NA.
Platinum-group metals and silver:			
Waste and sweepings:			
Silver troy ounces	675	--	
Other do	613,725	3,633	Japan 2,668; West Germany 965.
Metals including alloys:			
Platinum-group do	707	4,372	United States 3,022; Japan 1,093.
Silver do	482	32,376	Australia 26,364; United States 3,537; India 2,379.
Tin metal including alloys, all forms	91	104	Hong Kong 44; Malaysia 10; Thailand 4.
Titanium oxides	8,471	468	Mainly to United States.
Tungsten (wolfram) metal including alloys, all forms	8	20	United States 13; Republic of Korea 4.
Zinc:			
Oxide and peroxide	1,010	1,015	Japan 719; Philippines 273.
Metal including alloys, all forms	45	280	United States 157; Mexico 50; Japan 20.
Other:			
Ash and residue containing nonferrous metals	163	17,344	Kenya 17,344.
Oxides, hydroxides, peroxide of metals	401	72	Mainly to Philippines.
Metals including alloys, all forms:			
Metalloids: Silicon	45	--	
Pyrophoric alloys	12	--	
Base metals including alloys, all forms, n.e.s	1,878	90	United Kingdom 24; Malaysia 20; Philippines 20.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	168	19	Philippines 9; Saudi Arabia 6; Singapore 2.
Dust and powder of precious and semiprecious stones kilograms	711	1,171	United States 614; Hong Kong 557.
Grinding and polishing wheels and stones	1,611	2,038	United States 436; Thailand 397; Singapore 231.
Asbestos	2	--	
Barite and witherite	54	2	NA.
Boric oxide, acid, borates, perborates	(2)	37	Mainly to United States.
Cement thousand tons	1,562	1,146	Saudi Arabia 465; Hong Kong 258; Singapore 164.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	8	27	NA.
Fire clay	14	18	NA.
Other	326	231	NA.
Products:			
Refractory (including nonclay bricks)	6,450	5,986	Philippines 2,428; Indonesia 1,497; Hong Kong 1,074.
Nonrefractory	25,172	25,054	Hong Kong 9,753; Japan 4,652; Saudi Arabia 3,304.
Diamond, gem:			
Not set or strung thousand carats	120	15	NA.
Manufactured do	--	545	NA.
Diatomite and other infusorial earth	103	123	Malaysia 103; Philippines 20.
Feldspar and fluorspar	48	121	Hong Kong 91; Indonesia 30.

See footnotes at end of table.

Table 2.—Taiwan: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Fertilizer materials:			
Manufactured:			
Nitrogenous	25,760	8,000	Philippines 5,400; Malaysia 2,600.
Potassic	376	100	Hong Kong 100.
Other, including mixed	2,655	247	Hong Kong 169; Japan 60.
Ammonia	([2])	3	Mainly to Japan.
Graphite, natural	614	785	Republic of Korea 682; Sri Lanka 85.
Gypsum and plasters	535	1,564	Indonesia 1,385; Saudi Arabia 140.
Lime	4,240	1,640	Japan 1,632.
Mica, all forms	7	20	Mainly to Japan.
Pigments, mineral: Iron oxides, processed	77	53	Philippines 34; Thailand 10; Indonesia 5.
Precious and semiprecious stones, except diamond:			
Natural kilograms	44,086	45,952	Hong Kong 36,944; United States 8,042.
Manufactured do	31,099	60,489	West Germany 20,610; Japan 19,900; United Kingdom 9,955.
Salt and brines	14,078	12,377	Hong Kong 11,550.
Sodium and potassium compounds, n.e.s	78,320	53,587	Republic of Korea 19,724; Japan 17,806; Philippines 8,122.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	6,692	12,603	Mainly to Japan.
Worked	12,891	17,817	Japan 10,095; Saudi Arabia 1,884; United States 1,172.
Dolomite, chiefly refractory grade	2,311	21,390	Japan 18,400; Philippines 1,930; Indonesia 1,040.
Gravel and crushed rock, n.e.s	59,804	152,158	Japan 150,589; Malaysia 1,260.
Limestone (except dimension)	1,085	2,662	Hong Kong 2,477; Indonesia 120.
Quartz and quartzite	--	6	Mainly to Hong Kong.
Sand, excluding metal bearing	50,813	81,418	Republic of Korea 80,072.
Sulfur:			
Elemental:			
Other than colloidal	1,949	2,252	Indonesia 1,450; Malaysia 285; Philippines 190.
Colloidal	225	188	Singapore 88; Hong Kong 50; Thailand 40.
Sulfuric acid, including oleum	4,844	2,046	Hong Kong 1,754; Saudi Arabia 102; Bahrain 100.
Talc, steatite, soapstone, pyrophyllite	2,348	1,812	Indonesia 476; Thailand 466; Malaysia 410.
Other:			
Crude:			
Meerschaum, amber, jet	1	2	United Arab Emirates 2.
Other	325	4,180	Thailand 4,005.
Slag, dross, and similar waste, not metal bearing: Slag and ash, n.e.s	4,292	1,469	Singapore 580; Hong Kong 556; Philippines 300.
Oxides and hydroxides of magnesium, strontium, barium	1	--	
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	5,907	5,873	Saudi Arabia 2,839; Hong Kong 1,011; United Arab Emirates 447.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black and gas carbon:			
Carbon black	252	799	Thailand 420; Indonesia 302.
Gas carbon	7	11	Mainly to Hong Kong.
Coal	--	30	Philippines 30.
Coke and semicoke	8,015	10,102	Thailand 3,000; Indonesia 2,460; Malaysia 2,145.
Rare gases: Argon kilograms	1,100	1,980	NA.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	66	1,767	NA.
Kerosine, jet fuel, white spirit do	2,248	3,218	NA.
Distillate fuel oil do	1,090	3,835	NA.
Lubricants do	233	182	NA.
Other:			
Nonlubricating oils, n.e.s do	7	14	NA.
Pitch and pitch coke do	113	24	Saudi Arabia 10; Japan 4; Yemen (not further specified) 2.
Total do	3,757	8,990	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	199,256	201,316	Japan 171,160; Republic of Korea 11,400.

NA Not available.

[1] Compiled from official Taiwan trade returns, Monthly Statistics of Trade, Republic of China, December 1977 and December 1978.

[2] Less than 1/2 unit.

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Table 3.—Taiwan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS		
Aluminum:		
Bauxite and concentrate thousand tons	163	171
Oxide and hydroxide	8,976	42,579
Metal including alloys:		
Scrap	8,734	10,103
Unwrought	52,479	48,672
Semimanufactures	5,812	7,403
Arsenic:		
Natural sulfides	17	3
Trioxide, pentoxide, acids	264	213
Chromium:		
Chromite	7,706	3,327
Oxide and hydroxide	1,231	1,561
Cobalt oxide and hydroxide	32	31
Columbium and tantalum: Tantalum metal including alloys, all forms kilograms	98	501
Copper:		
Ore and concentrate	55,118	20,654
Matte	24	5
Copper sulfate	174	236
Metal including alloys:		
Scrap	10,522	14,014
Unwrought	37,838	38,891
Semimanufactures	20,435	21,076
Germanium metal including alloys, all forms kilograms	--	104
Gold metal, unworked or partly worked thousand troy ounces	459	262
Iron and steel:		
Ore and concentrate thousand tons	1,176	2,489
Roasted pyrite	77,560	74,209
Metal:		
Scrap	571,385	622,219
Pig iron, ferroalloys, similar materials	106,631	75,773
Steel, primary forms	94,108	27,255
Semimanufactures:		
Bars, rods, angles, shapes, sections	278,167	279,669
Universals, plates, sheets thousand tons	1,168	1,165
Hoop and strip	13,146	27,495
Rails and accessories	7,222	6,145
Wire	20,979	12,507
Tubes, pipes, fittings	30,350	44,998
Castings and forgings, rough	706	1,092
Lead:		
Oxides	1,709	2,210
Metal including alloys:		
Scrap	13,152	22,061
Unwrought	8,655	8,794
Semimanufactures	152	425
Magnesium metal including alloys, all forms	627	1,938
Manganese:		
Ore and concentrate	64,293	96,254
Oxides	3,419	3,307
Metal	35	36
Mercury 76-pound flasks	1,576	2,665
Molybdenum metal including alloys, all forms	28	40
Nickel metal including alloys, all forms	2,452	4,667
Platinum-group metals and silver:		
Ores and concentrates thousand troy ounces	64	(1)
Metals including alloys:		
Platinum-group do	152	131
Silver do	1,888	2,068
Selenium, elemental kilograms	3,698	4,862
Silicon metal	523	2,521
Tin:		
Ore and concentrate	167	60
Oxides kilograms	1,774	753
Metal including alloys, all forms	2,412	3,874
Titanium oxides	8,651	16,334
Tungsten metal including alloys, all forms	13	24
Uranium and thorium oxides	45	1
Zinc:		
Oxide and peroxide	824	911
Metal including alloys:		
Scrap	6,347	7,826
Blue powder	58	65
Unwrought	27,891	50,868
Semimanufactures	1,188	1,332
Other:		
Ores and concentrates:		
Of molybdenum, tantalum, titanium, vanadium, zirconium	27,788	22,823
Of base metals, n.e.s	531	50

See footnotes at end of table.

Table 3.—Taiwan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS —Continued		
Other —Continued		
Ash and residue containing nonferrous metals	14,396	18,682
Oxides, hydroxides, peroxides of metals, n.e.s	769	951
Metals including alloys, all forms:		
Metalloids, n.e.s	60	74
Alkali, alkaline earth, rare-earth metals	218	147
Pyrophoric alloys kilograms	1,384	2,508
Base metals including alloys, all forms, n.e.s	370	435
NONMETALS		
Abrasives, n.e.s.:		
Natural:		
Pumice, emery, natural corundum, etc	2,790	2,551
Dust and powder of precious and semiprecious stones kilograms	4,014	[illegible]
Grinding and polishing wheels and stones	598	581
Manufactured: Artificial corundum	4,248	6,060
Asbestos	25,343	24,892
Barite and witherite	2,880	10,340
Boron materials:		
Crude natural borates	787	739
Oxide, acid, borates, perborates	4,812	7,412
Bromine kilograms	794	5,708
Cement	8,870	11,684
Clays and clay products (including all refractory brick):		
Crude:		
Bentonite	5,375	5,077
Fire clay	957	1,707
Kaolin	32,418	42,171
Other	87,843	117,271
Products:		
Refractory (including nonclay brick)	16,701	12,407
Nonrefractory	4,508	12,809
Cryolite and chiolite	7	3
Diamond:		
Gem:		
Not set or strung thousand carats	--	1,135
Manufactured do	16,965	26,965
Industrial:		
Natural do	1,315	1,555
Manufactured do	135	45
Diatomite and other infusorial earth	1,431	[illegible]
Feldspar and fluorspar	28,471	[illegible]
Fertilizer materials:		
Crude, phosphatic	309,750	297,750
Manufactured:		
Nitrogenous	120,237	15,684
Phosphatic	--	5
Potassic	165,092	107,110
Other, including mixed	188	[illegible]
Ammonia	5	17
Graphite, natural	5,943	[illegible]
Gypsum and plasters:		
Gypsum	265,646	[illegible]
Plasters	2,104	2,170
Iodine	5	6
Lime	4	1
Mica:		
Crude, including splittings and waste	263	438
Worked, including agglomerated splittings	66	14
Pigments, mineral:		
Natural, crude	51	33
Iron oxides, processed	4,859	[illegible]
Precious and semiprecious stones, except diamond:		
Natural kilograms	934,309	[illegible]
Manufactured do	1,845	[illegible]
Salt and brines	393,374	[illegible]
Sodium and potassium compounds, n.e.s.:		
Caustic soda	157	97
Caustic potash and sodic and potassic peroxides	2,642	[illegible]
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	7,510	14,441
Worked	3,741	3,614
Dolomite, chiefly refractory grade	676	22,738
Gravel and crushed rock, n.e.s	1,816	[illegible]
Limestone (except dimension)	(4)	(4)
Quartz and quartzite	568	593
Sand, excluding metal bearing	704	[illegible]

See footnotes at end of table.

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Table 3.—Taiwan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
NONMETALS —Continued		
Sulfur:		
Elemental:		
Other than colloidal	198,952	176,855
Colloidal	117,780	187,499
Sulfur dioxide	12	38
Sulfuric acid, including oleum	7	16
Talc, steatite, soapstone, pyrophyllite	3,758	3,943
Other:		
Crude:		
Meerschaum, amber, jet kilograms	11,620	9,296
Other	82,912	91,076
Slag, dross, and similar waste, not metal bearing:		
From iron and steel manufacture	70,291	64,039
Slag and ash, n.e.s	8	28
Oxides and hydroxides of magnesium, strontium, barium	8,463	9,351
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	225	449
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	83	169
Carbon black and gas carbon:		
Carbon black	17,918	11,959
Gas carbon	(2)	(2)
Coal, all grades, including briquets thousand tons	758	1,369
Coke and semicoke	26,075	68,649
Hydrogen and rare gases	861	1,605
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	99,178	125,275
Refinery products:		
Gasoline do	(2)	(2)
Kerosine, jet fuel, white spirit do	(2)	--
Distillate fuel oil do	24,269	16,938
Lubricants (including grease) do	394	465
Mineral jelly and wax do	73	81
Other:		
Nonlubricating oils, n.e.s do	70	68
Liquefied petroleum gas do	903	959
Pitch and pitch coke do	39	54
Petroleum coke do	69	186
Bitumen and other residues and bituminous mixtures, n.e.s do	78	2
Total do	25,895	18,753
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	9,018	9,048

[1] Value only reported at $35,165.
[2] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—Taiwan Aluminum Corp. (Talco) is the country's sole producer of aluminum. Talco is 100% Government owned and was integrated from alumina production through the metal-semifabricating stage. In July 1977, a typhoon hit southern Taiwan, inflicting substantial damage to the industrial area of Kaohsiung. Smelter No. 1, with an annual capacity of 38,000 tons, was severely damaged by the typhoon.

Construction of Talco's unit No. 2 (annual capacity of 37,000 tons) was completed in 1976. However, full commissioning of the newly completed smelter was delayed until 1977. When Typhoon Thelma struck on July 25, the new smelter was only partially in operation. Because of storm damage, Talco operated at 40% of rated capacity in 1977, compared with 67% in 1978.

Alumina production was by Talco's caustic leach plant at Takao, also in the Kaohsiung area. Taiwan imports bauxite as the primary raw material for its aluminum industry. The traditional overseas suppliers of Talco were Seaba Co. of Alcan in Malaysia and Comalco in Australia.

The third-stage expansion project of Talco was completed in March 1978, costing about $73.7 million. The project included the expansion of the alumina plant and the addition of more rolling and processing facilities. Talco also planned to start the fourth expansion phase in December, whereby metal capacity would be increased to 90,000 tons per year.

The aluminum industry consumed 831.4 million kilowatt-hours of electricity in 1978 compared with 516.9 million in 1977. Talco supplies 30% of its energy requirement from its diesel-fed thermal generator and receives 70% of its energy from thermal and nuclear powerplants of Taiwan Power Co.

Copper.—Taiwan Metal Mining Corp. (TMMC), a Government owned company, controlled most of the copper industry in Taiwan. TMMC operates the only copper mine in Taiwan at Chinkuashih which produced about 1,000 tons (metal content) annually during the 1978-79 period. Copper concentrate is also imported to feed the smelter near the mine. Metal output capacity per year was 14,500 tons. TMMC/Lurgi Chemie was awarded contracts for plant construction of a 50,000-ton-per-year smelter at Taichung. Estimated cost of the project was $50 million with completion scheduled for June 1980.

Iron and Steel.—Taiwan's small magnetic placer operations are located along the northern coast between Tanshui and Wandi. Annual mine production is negligible compared with annual consumption, and most of Taiwan's requirements for iron ore and concentrate were met by large-tonnage imports from India and Australia to feed the Government owned integrated steel mill. Additionally, China Steel Corporation (CSC) reached an agreement to purchase 2.5 million tons of iron ore from South Africa for delivery over a 5-year period. The initial shipment of 500,000 tons, scheduled in July, will be transported by the Yi Li Shipping Company. The industry's demand for other ferrous metal requirements are met by imports of iron and steel scrap metal and by imports of old ships and vessels for scrapping. Power consumption by the iron and steel industry in 1978 was estimated at 2.4 billion kilowatt-hours.

CSC, a State enterprise, completed the first-stage construction of its integrated steelworks at Kaohsiung in late 1977. Presently CSC produces steel plate, rebar, wire rods, pig iron, and billet. Construction began on the second-stage facilities in May 1978 to increase the output capacity from 1.5 million tons of steel per year to 3.25 million tons. Upon completion of stage 2, CSC's products will include hot-rolled sheet, strips and sheets, cold-rolled sheet, and base plate. Second-stage construction was scheduled for completion in mid-1982, costing $1.4 billion, with financing provided equally by the Government and banking institutions. On October 6, 1979, CSC concluded a US$80 million loan agreement with a U.S. banking consortium headed by the Bank of America. The monies would provide about half of the investment required to finance the second-stage expansion (or the total cost of the first stage of the second-phase expansion project). A third-stage expansion was planned whereby annual capacity would reach 4.75 million tons, a target considerably below the original plans of 6 million tons per year. However, the final capacity will depend on market conditions.

As part of the Government's overall policy to establish and strengthen the economy, Taiwan Machinery Manufacturing Corp. (a State enterprise) had initiated five major projects (some of which were already underway), costing $238 million. The projects included a $24.7 million heavy machinery plant; a $30.8 million plant for producing large diesel engines, turbines, and other industrial equipment; a $1.8 million expansion of the tin electroplating plant; and a $158 million investment to develop heavy industrial equipment manufacturing capability. Intrinsic to the Government's scheme is to reduce expenditure on purchases of foreign industrial items which Taiwan is not presently capable of producing and to export eventually locally produced machinery to developing countries.

In August 1979, Tang Eng Iron Works Co. ratified a contract for the purchase of a US$60.9 million stainless steel plant from General Electric Co., Textron Inc., and Production Machinery Corp. The plant will have an annual capacity to produce 50,000 tons of stainless steel products. Financing for the purchase will be provided by a $47.3 million loan bearing an annual interest rate of 8% from the U.S. Export-Import Bank.

Other Metals.—Small quantities of gold were produced from vein deposits at the Chinkuashih mine. No placer deposits were presently being worked in Taiwan. In 1978, domestic production of gold was valued at NT$95 million, while the output of silver was valued at NT$15.6 million. Taiwan does not produce any primary zinc, lead, tin, or nickel, but consumes sizable tonnages of these metals annually. Industrial demand for these metals is met by imports primarily from Australia, Canada, Japan, Malaysia, and the United States.

NONMETALS

Cement.—There were 20 operating cement plants of 13 manufacturing companies

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in Taiwan with a total production capacity close to 12.3 million tons per year. Eighteen plants were in the west and two in the east. Most of the cement plants had their own limestone quarries, and only a few small plants purchased limestone raw materials from quarries operated by others. The east coast of the island was becoming the cement export center because of rich natural resources and Government directives aimed at accelerating the growth of eastern Taiwan. Also, the completion of the Suao-Hualien Railroad provides a direct link for cement plants to Hulien Harbor. Since 1975, exports of cement increased sharply, reaching 1.56 million tons in 1977, then falling to 1.14 million tons in 1978. The principal export destinations were Hong Kong, Singapore, and Saudi Arabia. Demand for cement, however, continued to increase owing to consumption resulting from construction in connection with Taiwan's Ten Major Construction Projects, construction starts of new Government projects, and an increase in export shipments. Total shipments in 1979 were estimated at around 11.5 million tons.

Taiwan Cement Corp. (TCC) was the largest producer on the island with four plants, one each at Kaohsiung, Chutung, Suao, and Hualien, and a combined annual capacity of 3.8 million tons. Asia Cement Corp., with a 2.5-million-ton plant at Tahu near Hsinchu, ranked next to TCC. The remaining cement capacity, 6.0 million tons, was distributed among 15 plants of 11 companies. The energy consumption by the cement industry was estimated at 1,424 million kilowatt-hours.

Construction of a new cement plant, with an annual capacity of 800,000 tons per year, was completed near yearend 1978. Hsin Hsin Cement Enterprise Corporation of Chayi is a newly established firm and is a joint undertaking of the Vocational Assistance Commission for Retired Servicemen and local businessmen. Asia Cement Company planned to invest $33.9 million in the construction of a second cement factory adjacent to its Hualien facility. When completed, the company's annual capacity will increase from 2.4 million to 3.4 million tons. New facilities and expansion to existing ones were expected to increase the country's annual capacity to more than 16 million tons by 1980.

On January 20, 1979, Chia Hsin Cement Corporation began construction of a 1-million-ton-per-year cement plant to be completed at the end of 1980. The new plant will feature U.S.-made equipment.

Fertilizer Materials.—In 1978, Taiwan produced 529,121 tons of ammonium sulfate, 533,583 tons of anhydrous ammonium, 253,774 tons of compound fertilizers, 174,754 tons of calcium superphosphate, 365,659 tons of urea, and 12,760 tons of nitrochalk. Taiwan has no potash resources and only small apatite resources. During 1978, Taiwan imported 314,950 tons of natural phosphates and 285,429 tons of chemical fertilizers to meet domestic demand for fertilizer materials. In 1978, energy consumption by the chemical fertilizer industry totaled 358.9 million kilowatt-hours of electricity. During 1978, Taiwan Fertilizer Company, a Government enterprise, exceeded its output target of 1.1 million tons of chemical fertilizers by 32,700 tons. However, sales during the year totaled 891,834 tons. The shortfall was credited to slackened demand in local markets.

Salt.—All salt production was by the Taiwan Salt Works, a Government enterprise. The saltfields are distributed along the southwestern coast, and crude salt was produced by solar evaporation. In 1978, salt production was about 155,000 tons below the 1976-77 level of output because of typhoon damage. Imports of salt were over a million tons. The largest consumer of salt was the soda-chlorine industry, which produced 121,364 tons of caustic soda, 325,665 tons of liquid soda, 71,820 tons of soda ash, and 25,796 tons of liquid chlorine.

Stone.—Dolomite deposits are extensive and widespread, particularly in eastern Taiwan. The most important dolomite quarries were situated along the Tachoshuichi stream north of Hualien, with lesser quarries operating near Hoping, Hojen, and Chungte. Total production of dolomite in 1978 was valued at US$3.6 million, compared with US$1.9 million in 1977. Most of the dolomite was used by ironworks, glass manufactures, and chemical plants.

Commercial limestone deposits occur in many parts of Taiwan, and large quarries were being worked, particularly in the southwest and east. Limestone reserves were estimated at more than 450 billion tons. Production in 1978 was valued at US$25.7 million compared with US$23.3 million in 1977. The cement industry continued to be one of the largest consumers of limestone. Considerable quantities were also used for sugar refining. Burned or cal cined limestone went into lime manufacture, and high-purity raw limestone was the chief raw material for making carbide cyanamide.

The crystalline limestone in the metamorphic terrain of eastern Taiwan is classified as commercial marble. The production of marble was valued at about US$13.2 million in 1978. Most marble consumption was by the cement and fertilizer industries. The percentage of the total output of marble used as a building stone was small but was increasing. The output of decorative marble in 1978 was 1.64 million cubic meters, compared with 1.62 million in 1977 and 1.24 million in 1976.

Other Nonmetals.—Sulfur production was mainly from the Kaohsiung refinery of Chinese Petroleum Corp. and from pyrite recovery from copper mining. Sulfur recovery during the year was about 10,000 tons. Taiwan produces small quantities of asbestos and gypsum from schistose rocks in the eastern part of the island. Production of other nonmetallic minerals included low-grade clay, gem stones, mica, glass sands, serpentine, and talc.

MINERAL FUELS[4]

Under the current economic plan, Government expenditures for major energy projects in 1978 were projected at $793 million. Included in the projects were construction of three nuclear powerplants (six reactors); five thermal power generators; three hydropower plants and one hydrorecycling (pump storage) powerplant; development and utilization of geothermal energy; and offshore exploration for oil and natural gas. Additionally, the Government announced a policy for large energy users to maintain at least a 60-day emergency stock of energy supplies to minimize the impact of supply fluctuation. Stockpile guidelines for large energy users were as follows: Users consuming more than 1,000 kiloliters of fuel per year were to maintain at least a 60-day stock of fuel; Chinese Petroleum Corp. shall maintain stocks of petroleum products sufficient to meet at least 90 days of domestic demand; Taiwan Power Co. was to maintain at least a 60-day emergency stock of coal for its thermal powerplants and an appropriate stock of uranium for its nuclear powerplants (and maintain contracts for at least a 5-year uranium supply); and natural gas distributors were to construct storage facilities for at least a half-month's supply.

Because most of Taiwan's energy is imported, the Government was planning the exemption of import duties on primary energy supplies. A preliminary proposal made by the Ministry of Economic Affairs to the Executive Yuan was referred to the Council for Economic Planning and Development for study and coordination among various Government agencies. If ratified, duty exemptions would apply to imports of coal, crude oil, liquid natural gas, and uranium.

Coal.—Coal, the most important mineral commodity mined in Taiwan, occurs mainly in northern Taiwan. The coalfields are geologically complicated, having abundant faults and folds. Generally, coal production has decreased annually since the 1960's.

By output volume, 92 mines produced less than 500 tons per month; 22 produced 500 to 1,000 tons per month; 54 produced 1,000 to 2,000 tons per month; 10 produced 3,000 to 5,000 tons per month; and 10 produced above 5,000 tons per month. Under the current economic plan, the target output for coal in 1978 was 3.1 million tons, a shortfall of 200,000 tons of actual output.

About 20% of the coal produced in Taiwan was classified as coking coal. Pioneer Chemical Corporation and Hsin-Chu Chemical Corporation operated the only byproduct coke plants in Taiwan; both also produced coal gas for municipal use. The principal domestic user industries were iron and steel works, carbide manufacturers, and the plastics industry.

Natural Gas.—The Government's target production of natural gas in 1978 was 2,145 million cubic meters. Actual output in 1978, however, was about 85% of the target. Production was largely from 20 wells in the Chinshui gasfield and from 29 producing wells in the Tienchenshan gasfield. Taiwan's reserve of natural gas was estimated at 29 billion cubic meters. While annual production is small by world standards, the reserves and output of natural gas were considered an important energy supplement sufficient to meet the current consumption level of natural gas. The Chinese Petroleum Corp. continued drilling for natural gas, but all wells were either dry or lacked sufficient gas reserves for commercial production.

Petroleum.—Domestic production of oil equals less than 2% of annual crude oil imports. During 1978, Taiwan imported 17,130,000 tons of crude oil, valued at $1,631 million, and 2,409,393 tons of refined petroleum products, valued at $208 million.

The Chinese Petroleum Corporation

(CPC), a Government owned enterprise, produces, imports, refines, and markets all petroleum, natural gas, and their products used in Taiwan. CPC owns seven 100,000-ton tankers and one 36,000-ton ship, which collectively are capable of handling 70% of the crude oil Taiwan imports. In addition, CPC maintains loading and storage facilities for the imported oil (the storage field contains six tanks capable of holding 450,000 tons of crude oil).

CPC has two refineries in operation at Kaohsiung; the first has a capacity of 334,500 barrels per day, and the second, which was put on-stream in 1977, a capacity of 100,000 barrels per day. Construction of a new refinery at Taoyuan, with a capacity of 100,000 barrels per day, was on schedule for completion. Additionally, CPC operates two petrochemical complexes: The larger one, at Kaohsiung, utilizes petroleum as its raw material, and the other, at Toufen in the north, uses natural gas. Kaohsiung has three naphtha crackers, one with a capacity of 54,000 tons of ethylene per year and two with annual capacities of 230,000 tons of ethylene.

Uranium.—The Atomic Energy Council and the China Phosphate Industries Corporation (a state-run enterprise) constructed a pilot plant for phosphoric acid uranium extraction. Overseas patent applications have been filed for this process, which was developed by the Atomic Energy Institute. The plant represents a significant step for domestic production of yellowcake for use in nuclear electric power generation in Taiwan.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from New Taiwan dollars (NT$) to U.S. dollars at the rate of NT$36.00 = US$1.00.

[3] Council for Economic Planning and Development. Industry of Free China. V. L1, No. 4, April 1979, 199 pp.

[4] Fareastern Economic Review Limited. Asia 1978 Yearbook. Hong Kong, 1978, pp. 313-320.

[5] AIT Taipei. State Department Airgram A-16, June 19, 1979, 4 pp.

[6] U.S. Embassy, Taipei, Taiwan, State Department Airgram A-58, June 8, 1978, 7 pp.

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The Mineral Industry of Tanzania

By David E. Morse[1]

The mineral industry of Tanzania continued to be a small contributor to the nation's primarily agrarian economy but was nonetheless an important source of foreign exchange in 1978-79. Tanzania's major mineral exports were diamond, salt, and gem-quality minerals. The Government-owned State Mining Corporation(SMC) controlled most of the nation's mining operations. In cooperation with geologic teams from foreign countries and the United Nations, the SMC was investigating deposits of iron, coal, gold, nickel, phosphate rock, and coastal sands that contained ilmenite, zircon, and rutile. Systematic geological mapping on a scale of 1:125,000 was continued by the staff of the Geology and Mines Division of the Ministry of Water Development, Energy, and Minerals. Service contracts were maintained for oil and natural gas exploration by foreign companies with the Tanzania Petroleum Development Corporation (TPDC).

An airborne geophysical survey that was intended to cover the entire country began in 1978. Preliminary reports from the survey indicated that several radiometric and gravitional anomalies had been located that warranted follow-up surface investigations, notably in southern Tanzania near the border with Mozambique.

Contributions provided by the United Nations Development Program and the Government of Ethiopia enabled Tanzania to begin building the East African Minerals Center at Dodoma near the Geology and Mines Division Headquarters. The center was being established to provide a variety of services to assist in mineral exploration and development studies for member governments. The original agreement for establishing the center was signed in 1975 by representatives from Botswana, Ethiopia, Kenya, Madagascar, Somalia, Tanzania, and Uganda.

Tanzania's third 5-year development plan (1977-81) projected an annual 6% increase in the gross domestic product (GDP). The plan emphasized self-sufficiency in food production and expansion of the nation's iron, steel, cement, fertilizer, textile, chemical, and energy sectors. The plan also called for increased import substitution which was to be accomplished by the processing of domestic raw materials into finished goods. Growth in the mining sector was targeted at 9.3% per year during the 5-year period. Total expenditures were projected at $3 billion[2] of which nearly half was expected to be raised from external loans and grants.

Tanzania's GDP grew by 5.5% (at constant 1966 prices) in 1978, but events during the year severely restricted the nation's economic performance in 1979. The 1978 spending boom, coupled with a costly conflict with Uganda, caused a drastic decline in Tanzania's foreign exchange reserves in 1979. World prices for the country's major agricultural exports also declined in the 1978-79 period, and prices for imported fuels and crude oil nearly doubled in 1979. Shortly after the conflict with Uganda began in October 1978, the Government commandeered a significant portion of the nation's heavy -duty trucks, which severely curtailed the movement of general supplies, spare parts, and petroleum products to many areas of the country and also to neighboring, landlocked Burundi and Rwanda. The lack of necessary supplies and the reduced flow of agrarian export items caused a decline in the performance of both the industrial and agriculture sectors in 1979. Strict Government actions to reduce imports and aid from European countries halted the drop in foreign exchange reserves late in 1979 but did not alleviate the country's underlying economic weaknesses.

PRODUCTION AND TRADE

Production statistics for most of Tanzania's mineral products were not available. As a result, the statistics that follow reflect a considerable use of estimates. Based on export data, diamond retained its position as Tanzania's most valuable mineral production in 1978 and 1979. Salt, gem stones, mica, and tin concentrate (cassiterite) were Tanzania's other important mineral export commodities in 1978 and 1979. The value of Tanzania's mineral exports was approximately $24 million for each of the two years and represented nearly 5% of the value of all exported goods. Tanzania produced gypsum, lime, cement, kaolin, bentonite, glass sand, and crude construction materials from indigenous deposits for domestic consumption. Imported materials were processed to manufacture fertilizer materials, steel products, farm implements, and metallic household utensils and fixtures.

The nation continued to rely on outside sources to supply a major share of its needs for iron and steel, aluminum, lead, zinc, fertilizers, and refractories. Cement was also imported in significant quantities. Imported crude oil and refined petroleum products were valued at nearly $140 million in 1978 and at $200 million in 1979; these imports represented approximately 10% of the value of all imported materials in 1978 and 18% of the total import value in 1979.

Table 1.—Tanzania: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^{p}	1979^{e}
METALS				
Gold, refined troy ounces	10	23	^{e}12	[illegible]
Silver, refined do.	1	--	--	[illegible]
Tin, mine output, metal content	3	--	3	[illegible]
NONMETALS				
Cement	241,000	260,000	231,100	[illegible]
Clays:				
Bentonite	--	35	20	[illegible]
Kaolin[e]	1,000	1,000	1,000	[illegible]
Diamond:				
Gem[e] [2] carats	219,104	204,016	146,655	[illegible]
Industrial[e] [2] do.	219,105	^{r}204,016	146,655	[illegible]
Total do.	438,209	408,032	293,310	[illegible]
Gem stones, precious and semiprecious, except diamond:[3]				
Amethyst kilograms	7	2	4	[illegible]
Aquamarine do.	(5)	NA	--	[illegible]
Beryl (gem only) do.	46	67	--	[illegible]
Chrysoprase and opal do.	(5)	--	23	[illegible]
Corundum (gem only) do.	--	--	--	[illegible]
Garnet and rhodolite do.	30	20	3	[illegible]
Ruby and sapphire do.	1	1	(5)	[illegible]
Scapolite do.	3	7	--	[illegible]
Tourmaline do.	13	3	(5)	[illegible]
Zircon do.	3	20	(5)	[illegible]
Zoisite (tanzanite) do.	10	(5)	11	[illegible]
Unspecified do.	33	55	21	[illegible]
Gypsum and anhydrite, crude	^{e}8,000	8,255	22,000	[illegible]
Lime, hydrated, and quicklime	^{e}2,000	^{e}2,000	2,500	[illegible]
Mica, sheet	7	7	6	[illegible]
Salt, all types	46,441	27,991	20,100	[illegible]
Stone, sand and gravel:				
Calcite	3	2	NA	[illegible]
Ornamental stone:				
Art stone	25	16	5	[illegible]
Amethystine quartz kilograms	3	2	4	[illegible]
Glass sand	28,000	28,000	28,000	[illegible]
Vermiculite[e]	20	20	20	[illegible]
MINERAL FUELS AND RELATED MATERIALS				
Coal, bituminous	3,000	3,000	3,500	[illegible]

See footnotes at end of table.

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Table 1.—Tanzania: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	[e]989	895	794	[1]781
Kerosine do	[e]212	349	328	[1]292
Jet fuel do	[e]420	241	173	[1]244
Distillate fuel oil do	[e]2,585	1,170	978	976
Residual fuel oil do	[e]2,361	1,847	1,573	[1]1,710
Liquefied petroleum gas do	[e]68	72	63	[1]78
Refinery fuel and losses do	[e]389	317	310	[1]300
Total do	[e]7,024	4,891	4,219	[1]4,381

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] Reported figure.

[2] Estimates based on reported total diamond output and best available information on the ratio of gem to industrial stones in total output.

[3] Exports.

[4] Reported figures for January-October only.

[5] Less than 1/2 unit.

Table 2.—Tanzania: Exports and reexports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1975	1976
METALS		
Aluminum metal including alloys:		
Scrap	139	65
Unwrought and semimanufactures	1,076	212
Copper metal including alloys:		
Scrap	160	387
Semimanufactures:		
Bars, rods, angles, shapes, sections	149	355
Universals, plates, sheets	16	41
Rails and accessories	9	--
Wire	27	16
Tubes, pipes, fittings	2,922	222
Lead metal including alloys:		
Scrap	253	145
Unwrought and semimanufactures value	$1,349	--
Tin ore and concentrate	40	22
Zinc metal including alloys, scrap	103	515
Other ash and residue containing nonferrous metals	48	70
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	--	15
Dust and powder of precious and semiprecious stones	(2)	--
Grinding and polishing wheels and stones	4	(2)
Cement	954	1,861
Clays and clay products (including all refractory brick):		
Crude	242	139
Products, refractory (including nonclay brick)	5	--
Diamond, gem, not set or strung thousand carats	595	446
Feldspar and fluorspar	6	--
Fertilizer materials, manufactured, phosphatic	718	--
Gypsum and plasters	1	3,600
Lime	1	--
Mica, crude, including splittings and waste	7	8
Precious and semiprecious stones, except diamond, natural value, thousands	$379	$477
Salt and brines	8,824	9,141
Stone, sand and gravel:		
Gravel and crushed rock	4	--
Quartz and quartzite	75	--
Sand, excluding metal bearing	--	3
Sulfuric acid, including oleum	372	--
Other, crude value	$3,123	$59
MINERAL FUELS AND RELATED MATERIALS		
Coke and semicoke	7	2
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	167	176
Kerosine do	26	31
Jet fuel do	61	92

See footnotes at end of table.

Table 2.—Tanzania: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976
MINERAL FUELS AND RELATED MATERIALS —Continued		
Petroleum refinery products —Continued		
Distillate fuel oil ... thousand 42-gallon barrels	147	150
Residual fuel oil ... do	1,308	[illegible]
Lubricants ... do	1	1
Other:		
Nonlubricating oils, n.e.s ... do	(2)	(2)
Liquefied petroleum gas ... do	(2)	4
Bitumen and other residues and bituminous mixtures, n.e.s ... do	(2)	--

[1] Exports to Kenya and Uganda, formerly treated as transfers, have been reclassified as regular exports.
[2] Less than 1/2 unit.

Table 3.—Tanzania: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1975	1976
METALS		
Aluminum metal including alloys:		
Scrap	28	--
Unwrought	1,680	[illegible]
Semimanufactures	454	[illegible]
Copper metal including alloys:		
Scrap	3	--
Unwrought	1	1
Semimanufactures	302	[illegible]
Iron and steel:		
Ore and concentrate	1,500	[illegible]
Metal:		
Pig iron, ferroalloys, similar materials	2,666	[illegible]
Steel, primary forms	11,617	[illegible]
Semimanufactures:		
Bars, rods, angles, shapes, sections	10,747	[illegible]
Universals, plates, sheets	21,029	[illegible]
Hoop and strip	8,301	[illegible]
Rails and accessories	18,880	[illegible]
Wire	6,490	[illegible]
Tubes, pipes, fittings	16,567	[illegible]
Castings and forgings, rough	13	[illegible]
Lead:		
Ore and concentrate ... value	$60	--
Metal including alloys:		
Scrap	1	--
Semimanufactures	32	[illegible]
Nickel metal including alloys, unwrought and semimanufactures ... value	$4,431	[illegible]
Platinum-group metals including alloys, all forms, but not rolled ... troy ounces	1	[illegible]
Silver metal including alloys, all forms, but not rolled ... do	96	[illegible]
Tin metal including alloys:		
Unwrought	12	[illegible]
Semimanufactures	10	[illegible]
Zinc metal including alloys:		
Blue powder	--	1
Unwrought	3,732	[illegible]
Semimanufactures	132	4
Other:		
Pyrophoric alloys ... value	$19	(2)
Base metals including alloys, all forms	1	[illegible]
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	11	[illegible]
Dust and powder of precious and semiprecious stones	2	[illegible]
Grinding and polishing wheels and stones	57	[illegible]
Asbestos	70	[illegible]
Barite and witherite	308	[illegible]
Cement	60,361	[illegible]
Chalk ... value	$118,558	[illegible]
Clays and clay products (including all refractory brick):		
Crude	1,062	[illegible]
Products:		
Refractory (including nonclay brick)	1,094	[illegible]
Nonrefractory	1,335	[illegible]
Diamond, gem, not set or strung ... thousand carats	124	[illegible]
Diatomite and other infusorial earth	290	--
Feldspar and fluorspar	116	[illegible]
Fertilizer materials:		
Crude:		
Phosphatic	22,213	[illegible]
Potassic	10	--

See footnotes at end of table.

Table 3.—Tanzania: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976
NONMETALS —Continued		
Fertilizer materials —Continued		
Manufactured:		
Nitrogenous	39,880	31,955
Phosphatic	1,307	1,515
Potassic	9,032	5,695
Other, including mixed	2,822	10,125
Ammonia	5,181	6,970
Graphite, natural	3	1
Gypsum and plasters	229	47
Lime	332	5
Magnesite	115	75
Mica:		
Crude, including splittings and waste ... value	$7,055	$14,743
Worked, including agglomerated splittings ... do	$6,608	$1,254
Pigments, mineral, natural, crude ... do	$8,691	$23,268
Salt and brines	1,176	2,240
Sodium and potassium compounds, n.e.s.:		
Caustic soda	2,352	6,857
Sodium carbonate (soda ash)	4,417	183
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	17	13
Worked	47	--
Dolomite, chiefly refractory grade	30	--
Gravel and crushed rock	97	--
Quartz and quartzite	2	2
Sand, excluding metal bearing	25	18
Sulfur:		
Elemental, other than colloidal	453	27,690
Sulfuric acid, including oleum	83	2,558
Talc, steatite, soapstone, pyrophyllite ... value	$73,952	$36,693
Other:		
Crude:		
Meerschaum, amber, jet	25	18
Other ... value	$24,512	$1,361
Slag, dross, and similar waste, not metal bearing, from iron and steel manufacture	357	42
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	5	--
Coal, all grades, including briquets	64	122
Coke and semicoke	521	833
Petroleum:		
Crude and partly refined ... thousand 42-gallon barrels	5,367	7,046
Refinery products:		
Gasoline ... do	143	175
Kerosine ... do	204	58
Jet fuel ... do	109	176
Distillate fuel oil ... do	700	664
Residual fuel oil ... do	52	--
Lubricants ... do	173	29
Other:		
Liquefied petroleum gas ... do	(2)	(2)
Mineral jelly and wax ... do	5	10
Nonlubricating oils, n.e.s ... do	4	7
Pitch and pitch coke ... do	1	(2)
Bitumen and other residues ... do	41	346
Bituminous mixtures, n.e.s ... do	26	73
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	486	(2)

[1] Imports from Kenya and Uganda, formerly treated as transfers, have been reclassified as regular imports.
[2] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Iron and Steel.—The Government planned to develop an iron and steel industry near Mbeya in southwestern Tanzania that would utilize domestic iron ore from the Chunya deposits and coal from the Songwe-Kiwira coalfields. The National Development Corp. planned to invest $6.5 million to increase the capacity of the Tanga Steel Rolling Mills Ltd. plant from 25,000 tons per year to 90,000 tons per year. The Tanga rolling plant produced wire, rod, bars, angles, and flat steel products from imported rolling stock.

NONMETALS

Cement.—Tanzania's only cement plant,

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at Wazo Hill near Dar es Salaam, continued to operate at less than capacity in 1978 and 1979. A third kiln completed in 1979 expanded the facility's capacity to 600,000 tons per year. A new 1,600-ton-per-day cement plant at Tanga in northeast Tanzania was scheduled to be in production in 1980. Also, an 800-ton-per-day single-kiln cement plant was planned to be built at Mbeya in the southwest. Tanzania Saruji Corp. awarded a contract to F.L. Smidth of Denmark to supply the major components for the Mbeya plant. Tanzania's cement industry expansion was designed to minimize cement imports and reduce foreign exchange expenditure.

Diamond.—There was a significant and unexplained drop in diamond output in 1978, and production in 1979 continued at a relatively low level. Diamond production had previously been declining because of a decrease in the grade of the ore processed. Despite the decreased level of production, diamond retained its positon as the most important mineral commodity exported by Tanzania.

Mica.—Exports of sheet mica decreased by 1,000 kilograms in 1978 compared with those of 1977; but the average price per kilogram increased more than fourfold, from $2.51 per kilogram to $11.27 per kilogram. Small quantities of material of exceptional quality brought prices of over $700 per kilogram in 1978. Although complete information on mica exports from Tanzania in 1978 was not available, it was known that the United States imported over 212 kilograms of sheet mica with an average f.o.b. value of $73.86. The traditional mica mining district is located in the Uluguru Mountains south of Morogoro in east-central Tanzania.

Phosphate.—West German experts who conducted tests on phosphate deposits near Lake Mangara in the Arusha region reported that the material was suitable for the production of all types of phosphatic fertilizers. The Tanzania State Mining Corporation planned to exploit the deposits to supply the 60,000- ton-per-year Tanga fertilizer plant, which manufactured complex fertilizers from imported materials.

MINERAL FUELS

Coal.—Coal was mined in the Songwe-Kiwira district of southwestern Tanzania for use by local tea plantations. SMC planned to boost production to 30,000 tons per year in an attempt to substitute coal for wood and charcoal, owing to heavy deforestation in areas adjoining settlements.

The Songwe-Kiwira coal deposits have been the subject of an intensive study conducted for the SMC by investigators from Mainland China. Results of the study were expected to be reported in early 1980. Tanzania planned to utilize the coal for the production of pig iron and steel by the mid-1980's.

Natural Gas.—The Oil and Natural Gas Commission of India, working under a service contract for the State agency TPDC, drilled a single well on Songo Songo Island in 1978. Natural gas was reported, but flow-test data were not released. TPDC estimated natural gas reserves at 1.04 trillion cubic feet in the Songo Songo Island gas-field.

Petroleum.—No significant petroleum exploration activity was reported in Tanzania during 1978. In 1979, Agip Tanzania Ltd. retained its service contract with TPDC covering a 16,486- square-mile area both onshore and offshore along the east coast. Ocean Exploration Co. was the only other company holding exploration rights under a service contract with the TPDC.

Imports of crude petroleum for the Dar es Salaam petroleum refinery, operated by the Tanzania and Italian Petroleum Refining Co. Ltd., continued to be restrained owing to Tanzania's shortage of foreign exchange. The oil refinery operated well below its 17,000-barrel -per-day capacity in both 1978 and 1979. The oil refinery was closed for the month of September 1979 because of supply disruptions and the lack of foreign exchange. Tanzania secured commitments from Iraq for crude oil supplies for 1980 which covered nearly two-thirds of the nation's requirements. The remaining third of the country's crude oil needs was to be supplied from Abu Dhabi under a long-term commercial agreement.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary values have been converted from Tanzanian Shillings (Tsh) to U.S. dollars at a rate of Tsh7.4149 = US$1.00.

The Mineral Industry of Thailand

By Gordon L. Kinney[1]

The year 1978 was one of vigorous growth for most sectors of the Thai economy. The mineral industry in particular had a good year, with the value of total mineral production more than 40% higher than in 1977. Moreover, the construction and manufacturing industries contributed significantly to the overall growth of the economy. Real growth of the gross national product (GNP) reached 8.7%, exceeding the Government's goal of 7.0% growth. The highly important agricultural sector recovered fully from the severe 1977 drought, despite major flooding in September and October of 1978. Paddy rice production during the 1978 crop year was expected to total about 16.5 million tons, or 1.5 million tons more than production for 1977.

In 1979, the agricultural and industrial sectors of Thailand's economy remained strong. Overall real economic growth was around 6%. The important rice harvest showed a small gain over 1978 and yielded an exportable surplus of 2.6 million tons. Other commercial crops, led by tapioca, did well during both 1978 and 1979.

The GNP for 1978 was reported at more than $21.7 billion,[2] reflecting a growth rate of more than 14% over the 1977 GNP, at current prices, and more than 8.7% in terms of constant 1972 prices. In 1979, the current-price GNP was estimated at over $25 billion, reflecting an increase of more than 16% over the 1978 current-price GNP.[3] Because of the continuing high rate of inflation, however, the 1979 current-price GNP represented an increase of only about 6% at constant 1972 prices. The official rate of inflation was recorded at 8.4% in 1978. In 1979, inflation was fed by large increases in the cost of energy imports, and the rate by yearend was estimated by various sources at between 10% and 20%.

The farming sector continued to employ about 70% of the labor force, but its relative importance in the Thai economy has declined since 1973, when farming accounted for 34% of the gross domestic product (GDP); in 1978, the farming sector's share of the GDP was a little over 27%. The mining and quarrying sector, however, has gained in relative importance. This sector's share of the GDP increased steadily from 1.3% in 1975 to 2.2% in 1978 and 1979. The increased importance of mining and quarrying was also reflected in the employment data which varied widely from month to month. Total mining industry figures (using December as the index month) showed that employment increased from 58,500 in 1977 to over 84,000 in 1978. Monthly employment figures through September 1979 were slightly ahead of those for the corresponding months in 1978. Tin and tin-tungsten operations were the dominant employers in Thailand's mining industry, and the country's relative dependence on tin operations for mining employment has increased steadily in recent years. The percentage of the mining work force that was employed by tin operations grew from 75% in 1974 to nearly 88% in December 1978.[4]

Developments in the tin sector combined to produce a 43% increase in the value of tin production in 1978 over that of the previous year. As in 1977, a major factor in the increased value of tin production was the continued increase in the world price of tin. In 1979, Thailand surpassed Bolivia as the world's second largest tin producer. Preliminary data showed that tin production through September 1979 was ahead of production for the corresponding period in 1978.

The long pricing impasse between the Government and Union Oil Co. was finally broken in September 1978 when the Government's Natural Gas Organization of Thailand (NGOT) and Union Oil signed a 20-year natural gas sales contract. The signing of this agreement removed the last obstacle for the development of large offshore natural gas deposits and the laying of a sea-floor pipeline to the Bangkok area. During 1979, contractors were chosen for the offshore platforms, and the pipeline construction contractor was expected to be chosen in January 1980. The first gas from these deposits was scheduled to begin flowing in October 1981.

At yearend, Texas-Pacific Co. and the Thai Government had still not signed a pricing agreement for Texas-Pacific's nearby gas discovery.

In December 1978, the Government created the National Petroleum Authority of Thailand (NPAT), which was established essentially as a vertically integrated Government oil company. NPAT was created to explore and develop petroleum resources, market products, control activities of the refineries, and transport crude oil and petroleum products. It was anticipated that NPAT would integrate the activities of all petroleum-related State agencies.[5]

PRODUCTION

The value of Thailand's total mineral production in 1978 was reported at $487 million, or 2.2% of GNP. This figure represented a record increase of 44% over the previous year's mineral production value and reflected both a larger output of mineral products and a higher world price of tin. Preliminary data for 1979 indicated that the value of total mineral production for that year was more than $600 million, reflecting another significant increase. Thai mineral production is strongly oriented toward the export market. Domestic demand was very low, and consumption of mineral products (excluding imports) totaled about $20 million, or just over 4% of the total value of mineral production.

As in the past, tin played the dominant role in Thailand's mining industry in 1978 and 1979. Tin-in-concentrate, valued at nearly $380 million, accounted for more than three-quarters of the total value of Thai mineral production in 1978. The 1979 production of tin was valued at over $500 million, or 83% of the total. Tin and tungsten led the industry in production value growth in 1978 with substantial gains, but nearly all the important mineral products showed increases in both tonnage and value for the year. The value of tungsten concentrate production for 1978 was approximately $57 million, and tungsten was the country's second ranking mineral by value.

Table 1.—Thailand: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Antimony:				
Ore:				
Gross weight	8,637	5,774	6,759	7,000
Metal content	3,671	2,454	2,873	2,900
Metal, smelter	470	159	35	[1]101
Chromium: Chromite, gross weight	--	495	65	42
Columbium and tantalum ores and concentrates, gross weight:[2]				
Columbite	--	33	64	22
Tantalite	7	41	--	41
Iron and steel:				
Iron ore (55% Fe), gross weight	25,000	63,470	88,121	[1]108,101
Pig iron	[r]18,334	19,612	21,108	30,234
Ferroalloys:				
Ferrosilicon	1,159	--	1,635	1,500
Ferromanganese	1,509	706	747	750
Steel, primary forms:				
Ingots	162,840	300,000	314,132	270,000
Billets	112,276		17,017	20,000

See footnotes at end of table.

Table 1.—Thailand: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS —Continued				
Iron and steel —Continued				
Semimanufactures (selected):				
Bars	93,210	NA	NA	NA
Galvanized iron sheets	[r]88,894	101,687	84,808	85,000
Tinned plates	26,215	36,118	43,939	40,000
Lead:				
Mine output, metal content of 42.5% Pb concentrate	904	506	1,677	[1]8,719
Metal: Unwrought ingot, secondary	825	1,181	1,101	1,000
Manganese ore:				
Chemical grade, over 75% MnO_2	130	63	78	50
Battery grade and chemical grade, 75% MnO_2	3,230	4,762	6,635	6,000
Metallurgical grade, 46%-50% MnO_2	46,865	72,137	65,498	30,000
Total	50,225	76,962	72,211	36,050
Rare-earth metals: Monazite concentrate, gross weight	--	--	[3]767	725
Tin:				
Mine output, metal content	20,452	24,205	31,423	[1]35,353
Metal, smelter, primary	20,337	23,102	28,945	[1]33,058
Titanium minerals: Ilmenite concentrate, gross weight	200	--	482	780
Tungsten concentrate:				
Gross weight	3,986	4,276	6,182	[1]3,543
Metal content	[r]2,050	2,204	3,187	[1]1,826
Xenotime	--	50	--	--
Zirconium ore and concentrate, gross weight	55	54	25	27
NONMETALS				
Asbestos	15	4	4	4
Barite	151,343	118,466	274,564	[1]378,654
Cement, hydraulic thousand tons	4,460	5,090	5,050	5,270
Clays:				
Ball clay	3,274	720	--	[1]1,766
Kaolin	16,660	24,360	33,764	[1]42,769
Kaolinite (dickite)	3,360	1,160	930	[1]1,320
Diatomite	--	190	1,105	1,090
Feldspar	12,257	17,619	32,583	31,800
Fluorspar:				
Crude mine output:				
High grade	128,529	193,315	175,531	182,000
Low grade	71,835	46,490	84,255	63,000
Total	200,364	239,805	259,786	245,000
Salable product:				
Acid grade (beneficiated low grade)	53,322	54,826	55,000	39,000
Metallurgical grade	128,529	193,315	175,531	182,000
Total	181,851	248,141	230,531	221,000
Graphite	30	23	23	--
Gypsum	267,822	380,090	280,904	[1]352,398
Nitrogen, N content of ammonia	7,000	7,000	9,000	--
Phosphate rock, crude	7,250	3,100	3,485	[1]4,542
Salt:				
Rock	[r]5,575	12,750	11,839	[1]11,000
Other[e]	165,000	165,000	165,000	165,000
Sand, silica	24,145	112,168	170,227	[1]157,076
Stone:				
Calcite	590	75	1,182	[1]1,860
Dolomite	30	3,370	4,400	[1]4,030
Limestone thousand tons	493	706	2,639	[1]2,964
Marble	--	--	--	4,896
Marl (used for cement) thousand tons	435	585	1,460	[1]2,262
Quartz, not further described	31,563	34,520	22,220	[1]22,240
Shale	74,504	180,696	484,518	[1]748,499
Talc and related materials:				
Pyrophyllite	5,787	9,851	12,190	12,700
Talc	770	517	2,698	2,700
MINERAL FUELS AND RELATED MATERIALS				
Coal: Lignite thousand tons	680	439	639	1,356

See footnotes at end of table.

Table 1.—Thailand: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude ---- thousand 42-gallon barrels	57	103	107	109
Refinery products:				
Gasoline ---- do	9,332	13,317	12,965	13,500
Jet fuel ---- do	7,673	4,732	4,750	5,000
Kerosine ---- do	976	1,761	1,643	2,000
Distillate fuel oil ---- do	15,835	17,591	16,200	17,000
Residual fuel oil ---- do	17,748	17,787	19,673	20,000
Other:				
Liquefied petroleum gas ---- do	2,590	NA	1,374	1,500
Naphtha ---- do	1,811	2,317	NA	2,000
Asphalt ---- do	783	NA	954	1,000
Unspecified ---- do	11,370	NA	223	500
Refinery fuel and losses ---- do	389	3,246	3,647	3,500
Total ---- do	68,507	60,751	61,429	66,000

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1]Reported figure.

[2]Excludes columbium- and tantalum-bearing tin slags, which make Thailand the world's largest source of newly mined tantalum.

[3]Exports.

TRADE

As a result of high world prices for tin and tungsten, Thailand exported minerals and metals worth over $440 million in 1978. Of this total, tin accounted for about $350 million. Exports of tin for the first 9 months of 1979 were valued at over $330 million. The other major exports were tungsten, gem stones, fluorite, antimony, and lead concentrate. A new lead concentrate processing facility that was brought into operation in 1979 contributed to a more than sevenfold increase in lead concentrate exports over exports for the previous year. Cement, formerly a major export item, was in short supply. Exports dropped to virtually nothing as cement became an imported item in 1978 and 1979. Overall, minerals ranked third as a major export group, following tapioca and rice exports in value.

The value of Thailand's total trade in 1978 came to $9.4 billion. Exports rose from $4.1 billion in 1978 to an estimated $5.2 billion in 1979. Imports, however, rose at an even faster rate, from $5.3 billion in 1978 to an estimated $7.5 billion in 1979. The trade deficit was projected at over $2 billion for 1979, or nearly twice the 1978 deficit, which had been held to a 10% increase over the 1977 deficit. Japan was again the main market for Thai exports, taking 20% of the total in 1978 and 22% of the total in the first half of 1979. The Netherlands, the United States, and Singapore followed Japan as major purchasers of Thai exports, taking 15%, 11%, and 8%, respectively, of the 1978 export total. These countries purchased approximately the same portions of Thailand's exports during the first 6 months of 1979.

Agricultural products were the major foreign exchange earners, accounting for over 50% of total exports in 1978 and 1979. In 1978, tapioca and rice exports were each valued at over $500 million and together accounted for more than 25% of total exports.[6] In addition, rubber, maize, and sugar together contributed another $800 million to the export market. Other agricultural exports generally showed small increases during 1978.

Thailand's major imports in 1978 were machinery, mineral fuels and lubricants, manufactured goods, and chemicals, in that order.[7] About 31% of total imports came from Japan; 14% came from the United States; and the Federal Republic of Germany and Saudi Arabia each supplied 6%. The value of mineral fuels accounted for over 21% of total imports in 1978 and nearly 22% of the total in the first 10 months of 1979.

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Table 2.—Thailand: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS		
Aluminum metal including alloys:		
Unwrought	--	300
Semimanufactures	1,312	1,450
Antimony:		
Ore and concentrate	[r]3,989	5,594
Metal including alloys, unwrought	45	73
Columbium and tantalum ores and concentrates	247	357
Copper metal including alloys, all forms	[r]7	27
Iron and steel metal:		
Pig iron, ferroalloys, similar materials	12	20
Semimanufactures	[r]12,140	30,966
Lead:		
Ore and concentrate	3,710	2,500
Metal including alloys, all forms	[r]51	1
Manganese:		
Ore and concentrate	55,322	37,941
Manganese dioxide, synthetic	--	31
Silver metal including alloys, all forms troy ounces	966,321	369,315
Tin metal including alloys, unwrought	[r]23,713	30,251
Titanium oxides	[r](1)	(1)
Tungsten ore and concentrate	[r]4,093	5,800
Zinc:		
Ore and concentrate	[r]17,480	--
Oxide	[r]34	52
Metal including alloys, semimanufactures	143	32
Zirconium ore and concentrate	[r]1	--
Other ores and concentrates	[r]200	80
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	[r]125	--
Grinding and polishing wheels and stones	[r]1	86
Asbestos	[r]200	--
Barite	[r]202,725	195,122
Cement	[r]313,229	22,607
Chalk	118	2
Clays and clay products:		
Crude:		
Fuller's earth, Dinas earth, chamotte	1,158	717
Kaolin	[r](1)	247
Products:		
Refractory	[r]1,202	1,693
Nonrefractory	[r]18,109	29,924
Diamond:		
Gem, not set or strung carats	367	6,934
Industrial do	--	1,500
Feldspar, leucite, nepheline syenite	[r]4,610	413
Fertilizer materials, manufactured, including mixed	[r]50	--
Fluorspar	219,047	205,697
Gypsum and plasters	60,437	83,532
Precious and semiprecious stones, except diamond:		
Natural:		
Precious thousand carats	15,637	19,528
Semiprecious kilograms	32,533	49,905
Manufactured do	170	73
Salt	77,157	92,943
Sodium and potassium compounds	22	6
Stone, sand and gravel:		
Gravel and crushed rock	28	5
Limestone	39	14
Quartz and quartzite	20,255	17,716
Sulfur, colloidal	23	340
Other: Slag, dross, and similar waste, not metal bearing	5,638	10,080
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	951	790
Carbon black	--	5
Coal, all grades, including briquets	--	53
Petroleum refinery products:		
Jet fuel thousand 42-gallon barrels	94	221
Lubricants do	[r]6	1
Mineral jelly and wax do	[r](1)	(1)
Other:		
Liquefied petroleum gas do	[r](1)	(1)
Unspecified do	[r]24	21

[r] Revised.

[1] Less than 1/2 unit.

Table 3.—Thailand: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS		
Aluminum:		
Bauxite and concentrate	12,316	5,911
Oxide and hydroxide	5,637	3,981
Metal including alloys:		
Scrap	1,386	1,456
Unwrought	33,240	34,019
Semimanufactures	4,173	4,935
Antimony:		
Ore and concentrate	26	--
Metal including alloys, all forms	249	(1)
Arsenic trioxide, pentoxide, acids	75	58
Cadmium metal including alloys, all forms kilograms	461	513
Chromium oxide and hydroxide	321	373
Cobalt:		
Oxide and hydroxide	4	11
Metal including alloys, all forms kilograms	274	30
Copper:		
Matte	19	19
Copper sulfate	222	373
Metal including alloys:		
Scrap	1,447	672
Unwrought:		
Blister and other unrefined	199	489
Refined, unalloyed	6,314	4,978
Semimanufactures	10,119	11,263
Master alloys	(1)	66
Gold metal, unworked or partly worked troy ounces	23,347	230,874
Iron and steel:		
Ore and concentrate	1,052	471
Metal:		
Scrap	443,615	301,963
Pig iron, ferroalloys, similar materials	27,168	4,730
Sponge iron, powder, shot	262	562
Steel ingots and other primary forms	333	79
Semimanufactures	1,049,605	1,108,974
Lead:		
Oxide	787	478
Metal including alloys:		
Scrap	457	298
Unwrought	7,304	9,460
Semimanufactures	r161	204
Magnesium:		
Oxide	42	31
Metal including alloys:		
Unwrought	r2	3
Semimanufactures	(1)	(1)
Manganese:		
Ore and concentrate	r3,688	1,028
Manganese dioxide, synthetic	1,589	1,195
Other oxides	r283	373
Mercury 76-pound flasks	245	169
Molybdenum metal including alloys, all forms	(1)	1
Nickel:		
Matte, speiss, similar materials	--	4
Metal including alloys:		
Scrap	--	13
Unwrought	r1	15
Semimanufactures	r552	341
Platinum-group metals including alloys, all forms troy ounces	2,475	3,002
Silver metal including alloys	r226	118
Tin:		
Oxides	(1)	2
Metal including alloys:		
Unwrought	r3	19
Semimanufactures	r7	12
Titanium:		
Ore and concentrate	r441	618
Oxide	1,577	1,442
Tungsten metal including alloys, all forms	1	1
Zinc:		
Oxide	262	365
Metal including alloys:		
Scrap	115	161
Powder and dust	r23	43
Unwrought	29,276	33,455
Semimanufactures	r186	178

See footnotes at end of table.

Table 3.—Thailand: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS —Continued		
Other:		
Ores and concentrates of base metals	^{r}16,804	16,970
Metals including alloys, all forms:		
Alkali, alkaline-earth, rare-earth metals kilograms	120	323
Pyrophoric alloys	53	63
Base metals including alloys, all forms, n.e.s	7	41
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	^{r}3,434	2,562
Dust and powder of precious and semiprecious stones kilograms	11	14
Grinding and polishing wheels and stones	^{r}1,698	1,931
Asbestos	52,455	50,690
Barite and witherite	37	60
Bromine:		
Elemental kilograms	--	39
Compounds	43	47
Cement	533	351,971
Chalk	1,365	1,118
Clays and clay products:		
Crude:		
Bentonite	1,622	2,163
Fire clay	3,050	40
Fuller's earth, Dinas earth, chamotte	3,516	13,687
Kaolin	1,342	2,296
Kyanite and sillimanite	10	4
Other	764	783
Products:		
Refractory (including nonclay brick)	6,611	6,054
Nonrefractory	2,030	605
Diamond:		
Gem, not set or strung carats	14,985	14,093
Industrial do	29,040	69,767
Diatomite and other infusorial earth	19	37
Feldspar, leucite, nepheline syenite	^{r}629	1,263
Fertilizer materials:		
Crude and manufactured:		
Nitrogenous	212,109	229,329
Phosphatic	16,300	4,670
Potassic	6,930	22,752
Other, including mixed	635,267	500,279
Ammonia, anhydrous	^{r}313	306
Fluorspar	80	752
Graphite, natural	^{r}1,324	1,494
Gypsum, anhydrite, plasters	415	294
Iodine	2	1
Lime	225	200
Magnesite	6,726	7,164
Mica	^{r}108	119
Pigments, mineral, including processed iron oxides	1,485	1,892
Precious and semiprecious stones, except diamond:		
Natural:		
Precious thousand carats	66,136	158,795
Semiprecious kilograms	^{r}219,507	177,510
Manufactured do	3,931	2,737
Salt	^{r}293	274
Sodium and potassium compounds	22,363	14,244
Stone, sand and gravel:		
Dimension stone:		
Crude:		
Calcareous (marble)	10	163
Slate	--	100
Other	553	466
Worked:		
Calcareous (marble)	1,949	867
Slate	254	87
Paving and flagstone	3	(1)
Other	^{r}607	248
Dolomite, chiefly refractory grade	10	60
Gravel and crushed rock	953	1,095
Limestone (except dimension)	2	--
Quartz and quartzite	360	376
Sand, excluding metal bearing	482	460
Sulfur:		
Elemental:		
Other than collidal	31,964	43,400
Colloidal	87	148
Sulfur dioxide	54	1
Sulfuric acid	31	35

See footnotes at end of table.

Table 3.—Thailand: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
NONMETALS —Continued		
Talc and steatite	10,776	15,100
Other:		
Crude	r883	1,010
Slag, dross, and similar waste, not metal bearing	--	1
Oxides and hydroxides of magnesium, strontium, barium	32	51
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	--	52
Carbon black	r14,863	15,783
Coal, all grades, including briquets	r2,470	13,694
Coke and semicoke	29,328	34,964
Petroleum:		
Crude and partly refined:		
Crude thousand 42-gallon barrels	54,563	56,621
Partly refined do	6,422	4,582
Refinery products:		
Gasoline:		
Aviation do	80	162
Motor do	409	1,618
Kerosine do	62	65
Jet fuel do	133	307
Distillate fuel oil do	r10,360	14,730
Lubricants do	r1,051	806
Other:		
Liquefied petroleum gas do	34	418
Mineral jelly and wax do	82	82
Nonlubricating oils, n.e.s do	72	166
Bitumen and other residues do	r9	14
Bituminous mixtures, n.e.s do	2	2
Pitch, pitch coke, petroleum coke do	29	39
Total do	r12,323	18,409
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	889	1,272

rRevised.
[1]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Antimony.—The value of antimony production in 1978 decreased by about 16%, despite an increase in production volume. Production of antimony concentrate in the first 9 months of 1979 was well ahead of production for the corresponding period in 1978 and ranked Thailand about fifth in world output. Production of antimony metal in 1978 was less than one-fourth the 1977 total, but production reversed in 1979 and showed a substantial increase.

Most of Thailand's antimony is mined in small-scale manual operations that are highly sensitive to price fluctuations. When the price falls too low, the diggings are simply closed until prices recover. Because of recent unstable marketing conditions, mine owners have been reluctant to make large capital investments for modernization or to increase production capacities.

Most of Thailand's antimony was mined for the export market. Exports were valued at over $4 million in 1978 and at $4.2 million for the first 9 months of 1979.

Iron and Steel.—Iron ore production was of little significance to Thailand's mineral industry in 1978, despite a production increase of almost 40% over the previous year's output. In 1979, the upward trend in production continued. Thailand's production of iron and steel was all consumed locally in the Siam Iron and Steel Co. Ltd.'s small blast furnace (which had a capacity of less than 100,000 tons per year). Thailand consumes over 1 million tons per year of steel, most of which is imported. The small domestic smelters and rerolling mills, using imported scrap as raw material, primarily produce structural and reinforcing bars for the construction industry.

Thai industry and Government planners have long considered establishing an integrated steel industry, but economic conditions and the lack of raw materials have

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been continuing deterrents. However, the discovery and imminent development of natural gas deposits in the Gulf of Thailand have improved the prospect for establishment of such a steel industry. A detailed feasibility study, commissioned by the Government in November 1977, was completed and submitted to the Industry Ministry in early 1978. The study, undertaken by Austromineral-Austroplan of Austria, suggested that a 600,000-ton-per-year direct-reduction (D-R) plant based on natural gas would be a suitable first step in the development of an integrated steel industry. Thai scrap supplies are uncertain, but it is anticipated that the proposed D-R plant would ensure dependable supplies of sponge iron for electric-furnace steelmaking. Laem Chabang or Sattahip, both coastal sites, were suggested as possible locations.[8]

Tantalum.—Thailand was the world's largest producer of tantalum source materials in 1978 and 1979. Tantalum occurs with tin ore and is generally obtained in Thailand in one of the following ways: 1) from the processing of tin smelter slags, 2) from the processing of tin mine dumps for struverite, and 3) as a tantalite-columbite concentrate separated physically during the tin ore concentration cycle.

Slag from the Thaisarco tin smelter in Phuket is particularly rich, ranging from 11% to 14% Ta_2O_5 and from 7% to 9% Cb_2O_5.[9] All of the slag from this smelter was exported in 1978 and 1979. Several companies have applied separately for Government permission to build treatment plants at Phuket for the extraction of tantalum from tin slag.

Tin.—Tin continued to be Thailand's most valuable mineral commodity during 1978. Total production of 73%-tin concentrate from all mining methods was reported at over 41,000 tons, reflecting an increase of almost 25% over the previous year's production. The smelting of concentrate by the Thaisarco plant produced nearly 29,000 tons of metal, or more than 12% of world production. Total tin production was valued at about $378 million in 1978, representing an increase of almost 50% over output for 1977. The increased value of production was a result of the large increase in world tin prices. In addition to the officially reported production, an estimated 2,000 to 3,000 tons per year of tin concentrate, and possibly much more, may have been smuggled out of Thailand during 1977 and 1978 to avoid payment of Government royalties.

In the first quarter of 1979, tin production and export revenues increased. However, production in the second quarter declined to slightly below that of the corresponding period in 1978 and then dropped in the third quarter to well below the 1978 third-quarter level.

A breakdown of tin mining methods showed that gravel pumping still predominated but was losing ground to other techniques. Offshore dredging was expected to show a continuing gain in the percent contributed to total output during the next few years. Small suction boats employed by far the most miners during 1978, followed by onshore gravel pumping operations and dulang washers. The big commercial dredges employed relatively few workers, probably less than 4% of the tin mining labor force.

On February 8, 1978, the Ministry of Industry issued a new schedule that lowered the tin tax royalty rate. The revised sliding scale tax rate varies according to how much tin is produced by the company or lease-holder. The 4.4% business tax and the tax royalty combined will take a maximum of about 32.5% of the miner's smelter return on concentrates; under the old rate, imposed in July 1977, the combined tax share was about 37%. By lowering the tax, the Government hoped to reduce the lucrative smuggling of tin and help stimulate the growth of the industry.

In January 1978, the Thai cabinet approved a proposal for a large new offshore dredge. The Offshore Mining Organization (OMO) shortly thereafter awarded an $18 million contract to Mining and Transport Engineering B.V. Co. Ltd. of Amsterdam. It was anticipated that the new 0.45-cubic-meter-bucket (16-cubic-foot) ladder dredge will displace 4,000 tons and will be able to operate in 100 feet of water at the rate of 330,000 cubic meters of ore per month. Special equipment was expected to enable the dredge to operate in 2.5-meter bow waves or 1.5 meter waves on the beam. It was also anticipated that operations will be possible about 8 1/2 months of the year, which would be a considerable improvement over most other offshore dredging equipment. The OMO planned to operate the dredge directly, rather than through a contractor. The Government thereby hoped to increase its tin revenues considerably and also keep a tight control on offshore mining operations. Construction progressed satisfactorily during 1979, and delivery of the dredge was scheduled for the spring of 1980.

The OMO continued to sign contract-dredging agreements with dredge operators during 1978. The operators were required to meet criteria set by the Thai Government, and one of these criteria was that the operators be partially owned by Thai stockholders. By early 1979, several companies were operating a total of about nine dredges under OMO contracts. The main legal producers of tin concentrate from the offshore areas were Billiton Thailand Ltd.; Sethasap Mining Co. Ltd. (formerly Sethasap Karn Ree. Co.); Aokham Tin Co., Ltd. (formerly Aokham Tin Berhad Co. of Malaysia); Southern Kinta Associated Co. Ltd. (formerly Southern Kinta Consolidated Berhad Co. of Malaysia); and Tongkah Harbor Tin Co. Ltd.

Offshore mining was complicated by the presence of thousands of small suction-pump mining boats operating in the shallow offshore areas. The OMO reserved an area of about 4,000 hectares for these boats to exploit on condition that production be sold to the Government. The 4,000 hectares was quickly depleted of high-grade ore, and many of the boats resumed illegal operations in OMO territory. The small operators skim the richest pockets of ore and recover only about 30% of the tin present. The deposits that remain are uneconomic or just marginally profitable for the big contractors. In mid-1979, Southern Kinta Associated Ltd. halted offshore dredging operations near Takuapa because of poor production from its leased area. The area had been heavily poached by suction boat operators.

In mid-1978, the Government decreed that all illegal suction boat activities must cease by June 1979. The original deadline was not enforced, and a new deadline of May 31, 1980, was set. The suction boats will be difficult to curtail, and it was generally conceded that the use of force to stop their activity would be politically undesirable. Over 30,000 people were involved in illegal dredging operations, and their officially reported output in 1978 amounted to nearly one-third of the country's total.[10]

Planning continued on the Thailand present and Smelting Co. Ltd.'s new 3,600-ton-per-year tin smelter. The plant will be Thailand's second major facility for smelting tin. Original plans called for the plant to be located in Nakon Pathom near Bangkok in order to save costs of shipping ore concentrates from the North. In late 1979, however, it was reported that the planned plant's location had been changed to Phuket, far to the south.

Plans for a third tin smelter were delayed during the latter part of 1977 and the first half of 1978 for lack of financing. Subsequently, Thai Pioneer Enterprise Co. signed an agreement with Lurgi Chemie Huttentechnik GmbH of West Germany for construction of a plant near Pathum Thani about 30 kilometers north of Bangkok. The initial annual production of tin metal is expected to be 3,600 tons, rising to 5,200 tons over the ensuing 4 years. The plant was scheduled for completion in late 1980.[11]

Tungsten.—In August and September 1978, conflict centered around a newly discovered wolframite deposit being worked without Government sanction at Doi Ngom (Doi Tham Ngom Hill) in Phrae Province. An estimated 4,000 to 5,000 illegal miners had moved into the area, and the resulting disorder was similar to that which occurred at the rich Khao Soon Mine in the mid-1970's. Thai authorities were hesitant to remove the fortune seekers, but finally called in police in mid-September to restore order. The Thai Cabinet approved a proposal to control the illegal mining and protect the rights of concessionaires, and by early 1979, the situation was reported under control. In April 1979, a mining lease was granted to Doy Ngom Corp. (owned 40% by the Phrae District Government, 40% by local private interests, and 20% by the Thai central Government). The new company was working out marketing arrangements prior to the actual start of its mining operation.

Production at the Khao Soon Mine, which produced much of Thailand's tungsten in 1978, dwindled in 1979 to around 100 tons per month.[12]

Tungsten concentrate has been Thailand's second most valuable mineral commodity since 1972. In 1978, despite a substantial 44% increase in production over that of 1977, the value of Thailand's tungsten production increased only about 25% because of a general lowering of world tungsten prices. The country's tungsten production of almost 6,200 tons ranked Thailand as fifth in world output among the market economy countries. However, inefficient labor-intensive mining methods have tended to leave behind significant amounts of low-grade tungsten ores. As a result, many mines with substantial low-grade reserves were being closed as uneconomical to operate. This resulted in a significant drop in production and exports of tungsten ores during 1979.

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There were 21 tungsten lode mines and 182 tin-tungsten placer mines in operation at yearend 1978. Over 700 people were employed in lode mining. About 6,300 additional workers were counted as mainly tin miners, but they also contributed a significant proportion of the tungsten mined from the combined tin-tungsten operations.

At yearend 1979, the Government was considering a proposal by Siam Tungsten to build the country's first ammonium paratungstate plant at Ayuttahya, near Bangkok. The plant was expected to cost $11 million and a capacity of 3,000 tons per year was projected.

Zinc and Lead.—In September 1978, New Jersey Zinc Co. announced the sale of its 55% interest in Thai Zinc Ltd. to Whashin Industrial Co. Ltd. of the Republic of Korea. Whashin was the proposed prime contractor for a planned 60,000-ton-per-year zinc refinery at the provincial capital of Tak. The Government's plan was to form a joint venture, with Thai interests holding 55%, and to limit foreign shares to a maximum of 45%. Thailand's participation was expected to include the Government (with a 20% share), the Sino-Thai Engineering and Construction Co. (10%), and another interest, possibly Industrial Finance Corp. of Thailand (25%). The foreign share was expected to be held by Whashin and a Belgian firm, Vielle Montaigne-Mechim, which was also expected to supply zinc-extraction expertise.

However, delays in arranging financing for the proposed refinery continued throughout 1979. The estimated cost of the plant had risen from $95 million to $120 million. At yearend 1979, Thai officials stated that the company must begin plant construction by April 5, 1980, or forfeit all development rights to the project.[13]

A small lead deposit was developed west of Bangkok. It was reported that Metallgesellschaft AG and Phoi and Sons Co. Ltd. constructed a small lead beneficiation plant at Srisawat in Muang District of Kanchanaburi Province. The plant was designed for 150 to 200 tons per day of concentrate with provision for doubling of output.[14] The plant was completed in late 1978. The value of lead concentrate production increased from $1.3 million in 1978 to $10.6 million in 1979. Almost all of this increase came from the new facility.

NONMETALS

Barite.—Thailand's barite mines had particularly good years in 1978 and 1979. Production in 1978 more than doubled over that of 1977 and was worth about $14 million. Barite was the third most valuable mineral produced in Thailand in 1978. Also in that year, about $5 million worth of barite was exported to foreign oil exploration industries. The production increase continued in 1979, with about the same amount of barite mined in the first 9 months as was mined in all of 1978. The Thai Board of Investment (BOI) had been studying the barite industry with regard to promoting and diversifying investment in domestic mineral industries. It was also interested in increasing the value of Thailand's mineral resources by encouraging as much domestic processing of materials as is possible. The BOI study recommended diversifying usage of domestic barite resources, particularly in nondrilling mud applications. It suggested the possibility of an integrated barium chemical plant for the production of lithopone and barium carbonate.

Cement.—The cement industry continued to operate at its design capacity during 1978 and 1979. Nonetheless, its annual production of over 5 million tons was not sufficient to satisfy demand, and Thailand was forced to import about $19 million worth of foreign cement in 1978. This was of particular concern to the Government because Thailand was a substantial exporter of cement until 1977.

In an effort to increase production, the BOI in August 1977 announced it would accept applications for new cement plants. By February 1978, the BOI had received 10 applications for construction of cement projects ranging in capacity from 800,000 tons per year to over 2 million tons per year. After evaluating the applications, the BOI awarded promotional tax and zoning privileges to four firms in May 1978 and to an additional new company later in the year. Planning for expansion were the Siam Cement Co. Ltd., which planned to increase capacity by over 1 million tons per year at its Thung Song plant in Nakhon Si Thammarat and also planned to increase capacity by the same amount at its Tha Luang plant in Saraburi; and the Siam City Cement Co. Ltd., which planned to increase the capacity of its Saraburi plant by 1.5 million tons per year. New projects were planned by the Mah Boonkrong Cement Co., which expected to produce 800,000 tons per year at a plant planned to be built near Korat; and the Thai Cement Industry Co., which was planning an 825,000-ton-per-year plant at

Saraburi. The later approval went to a Thailand-Republic of Korea joint venture expected to produce 1.6 million tons per year, of which 70% was expected to be exported.

Approval by the BOI only gives permission to build and does not mean that construction of a project is assured. Often the company fails to get financing, or conditions change, and the project founders. However, construction at Siam Cement Co.'s Thung Song site did begin in 1978 and progressed rapidly during 1979. Also, a contract was signed in 1978 for the Tha Luang plant, and construction began in early 1979.

Fluorite.—The fluorite industry employed about 2,800 people in 47 active mines at the end of 1978. The value of fluorite production continued a modest rise in 1978 for the second year, after experiencing rather sharp declines starting in 1974. The value and tonnage of exports, however, declined slightly from the 1977 level. Fluorite production in 1978 was valued at nearly $10 million, and fluorite fell from its position as the country's third most important mineral product to fourth most important in 1978. The 1979 production continued at about the same pace as in 1978.

The Japanese steel industry had been the major market for Thai fluorite until a slump in world steel production that began in 1974 and a reported drop in the quality of Thai fluorite caused a decline in exports. Despite the rebounding of steel production to almost prerecession levels, the Japanese steel industry had not resumed purchasing Thai fluorite at the former level. Efforts to find new markets were only partly successful. The Thai Commerce Ministry revealed that Romania had agreed to buy 6,500 tons of fluorite per year, but delivery and price details were not available.

The BOI completed a preliminary study of the domestic fluorite industry as part of its effort to promote and diversify investment in local mineral industries. The study suggested establishment of a fluorite briquet plant, a hydrofluoritic acid facility, and a synthetic cryolite plant. The study suggested that development of these plants would increase the overall value of domestic fluorite output, create new job opportunities, and increase foreign exchange earnings considerably.

Salt and Potash.—The Thai Government continued seeking ways to develop the huge rock salt deposits in the northeast, where reserves were estimated at around 4.8 billion tons. The basic project that is envisioned would consist of a 1- to 2-million-ton-per-year salt mine and 400,000- to 500,000-ton-per-year soda ash plant with downstream facilities. A detailed feasibility study was completed during 1978; it concluded that the technical aspects of the mine and plant were satisfactory. However, the viability of the project was contingent on competitive pricing and its projected profitability. The project would require a large expenditure for infrastructure development, particularly for rail and port facilities. Early in 1979, it was reported that the project was going ahead. In October 1979, it was further reported that the Thai Asahi Glass Co. was to set up a holding company to control Thailand's two-thirds equity share in the project. Total investment in the project was estimated at around $230 million. The other four Association of Southeast Asian Nations (ASEAN) nations, Malaysia, Singapore, Indonesia, and the Philippines, were expected to share a small part of the equity.[15]

Soda ash was the largest chemical import into Thailand, by volume, in 1978. Thus, development of the soda ash industry and its related chemical plants would be beneficial to the Thai economy because it would reduce the country's balance of trade deficit.

The Government was promoting the development of large potash reserves in the remote Khorat and Sakon Nakhon Basins in the northeast. A large market exists in the south and east Asian area for potassium for the fertilizer industry. While Thailand's reserves are the only large high-grade deposits in the area, a great deal of capital investment would be required for their development and production. Consequently, investors have had reservations about the project's economic viability. The only company to show an interest in these reserves was Amax Exploration Inc., which submitted a proposal to the Government late in 1979 for exploring and mining on the Khorat Plateau. Amax's target was an area located in the Wanoniwat District in Sakon Nakhon Province, where sylvite occurs in bodies up to 34 meters thick. The deposits are at depths as shallow as 90 meters.[16] [17]

MINERAL FUELS

Lignite.—Production of lignite jumped by more than 45% over the previous year's production in 1978, then more than doubled in 1979. The source of this increase was the Mae Moh Mine in Lampang Province, which completed a major expansion in 1978. In Thailand, the primary use of lignite is for

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the generation of electric power at onsite thermal powerplants. At Mae Moh, the first 75,000-kilowatt turbogenerating unit was completed early in the year, and a second 75,000-kilowatt unit was scheduled to come online by yearend 1978. In addition, a third 75,000-kilowatt unit was scheduled for completion in 1981, and two 150,000-kilowatt units were planned for the mid-1980's. In November 1979, the Asian Development Bank management proposed an $82 million loan to cover part of the cost of installing the 150,000-kilowatt Mae Moh No. 4 generating unit. A continuing development program at the mine was planned to provide additional fuel as the later generating units are installed.

Production at the Krabi lignite mine in southern Thailand remained at about the 300,000-ton-per-year level. Reserves at the Krabi deposit are not large, however; and in order to assure continued production, site preparations for construction of new mining operations at nearby Klong Wai Lek and Klong Bang Mark were planned to begin at yearend 1978. Lignite from these new mines was expected to be available for the Krabi thermal power plant in 1980.

Natural Gas and Petroleum.–On September 28, 1978, Union Oil Co. of Thailand finally signed a contract with the Thai Government setting the conditions of sale for the natural gas discovered in Union's offshore contract area in the Gulf of Thailand. After months of tedious negotiations, agreement was reached on a price of $1.04 per thousand cubic feet. The contract stipulated a maximum wellhead delivery rate of 250 million cubic feet per day. Signing of the contract allowed Union to begin design and construction of production platforms and drilling of production wells. Responsibility for laying an undersea pipeline and construction of the gas processing plant and distribution system rested with the Thai Government. Fluor Corp. was hired as the major pipeline contractor. The 86-centimeter-diameter (34-inch) pipeline was planned to run about 425 kilometers from the field northward to landfall at Sattahip, southeast of Bangkok. After processing onshore, plans were for the gas to be moved 160 kilometers to the Bangkok area via a 71-centimeter-diameter (28-inch) pipeline. The estimated cost of the project was between $400 million and $700 million.

The Union Oil-Mitsui Oil Exploration Co. partnership (40% Mitsui) continued exploration drilling during 1979 and announced a gas discovery in exploration block 10 about 300 kilometers north-northeast of Songkhla. A confirmation well was being drilled 3 kilometers northeast. In June 1979, Union Oil was awarded the concessional rights for drilling in exploration block 23, northwest of its discoveries in blocks 12 and 13.

Pricing negotiations began late in 1978 between the Government and the Texas Pacific Thailand Inc. consortium (TexPac), but ended in deadlock in December 1978. TexPac was ready to begin development of its large gas discovery upon resolution of the price controversy. Its field is located about 135 kilometers southeast of the Union field and about 200 kilometers east-northeast of Songkhla. Negotiations were scheduled to resume near the end of 1979 on the pricing controversy. Virtually all other conditions on the gas sale have been mutually agreed upon.[18] Plans were to connect the TexPac field by pipeline to the pipeline that was planned for servicing the Union field. It was anticipated that gas from both fields would then be transported via the pipeline to Sattahip. Although the gas composition differed in the two fields, it was believed that no serious problems would result from mixing the gas. Development of this field was estimated at about $450 million, not including the $47 million already spent by TexPac for exploration. TexPac hit commercial gas flows in two more wells in the same area at yearend 1978.

Proved and probable gas reserves in the Gulf of Thailand were estimated at 6.6 trillion cubic feet by the Government, and TexPac owned rights to about two-thirds of the total. Deep exploration drilling in the Andaman Sea off western Thailand has been discontinued, with no commercial finds reported.

It was announced that subsidiaries of Royal Dutch/Shell Group and Exxon Corp. signed 8-year onshore oil exploration agreements with the Government early in 1979. Shell Exploration B. V. received drilling rights to a 72,000-square-kilometer area of the Chao Phraya River Basin, roughly between Sukhothai (17°01'N, 99°49'E) and Ang Thong (14°35'N, 100°27'E). Esso Exploration Inc. planned to explore a 52,000-square-kilometer concession around Nokhon Ratchasima, (14°58'N, 102°07'E), and this exploration was expected to be the first comprehensive oil exploration in either of these areas.

The Government announced the establishment of the National Petroleum Authority of Thailand (NPAT). NPAT was set up as a state enterprise and was intended to include all functions concerned with the petroleum and natural gas sector. Its responsibilities included the surveying, production, transportation, and distribution of petroleum and related products.

At yearend 1979, the Thai Cabinet approved the expansion of the Thai Oil Refinery Co. (TORC) from 65,000 barrels per day to 120,000 barrels per day. The cost of the expansion was estimated at $300 million. The Government, through the NPAT, planned to acquire a 49% share of TORC; the private TORC group was slated to own 49%, and the Bureau of Crown property was to hold the remaining 2%. The other two major refineries were also considering expanding throughput capacities.

Domestic oil production was economically insignificant at less than 300 barrels per day. The country's three large refineries operated entirely on imported crude oil, mostly from the Persian Gulf countries. When the gas pipelines become operational, in late 1981 or 1982, it was expected that there will be an increase in domestic petroleum production of several thousand barrels per day, in the form of light-end gas condensates. The main anticipated benefit, however, was that energy from domestic natural gas production was expected to replace about 30% of the current crude oil imports.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Thai baht (B) at the rate of US$1.00=B20.42 in 1979, US$1.00=B20.34 in 1978, and US$1.00=B20.0 in 1977 and 1976.

[3] U.S. Embassy, Bangkok, Thailand. State Department Airgram A-110, Nov. 21, 1979, p. 3.

[4] Mineral Resources Gazette (Bangkok). V. 24, No. 4, April 1979, p. 93.

[5] Petroleum News. V. 10, No. 1, April 1978, p. 12.

[6] Bank of Thailand Statistical Bulletin. V. 19, No. 3, March 1979, pp. 50-51.

[7] Mineral Resources Gazette (Bangkok). V. 24, No. 4, April 1979, p. 44.

[8] Business Review (Bangkok). V. 7, No. 6, July 1979, pp. 526-535.

[9] Tantalum Producers International Study Center. Quarterly Bulletin. Issue No. 18, June 1979, p. 4.

[10] Metals Week. V. 50, No. 37, Sept. 10, 1979, p. 3.

[11] U.S. Embassy, Bangkok, Thailand. State Department Airgram A-047, May 11, 1978, p. 4.

[12] Metal Bulletin. May 15, 1979, p. 25.

[13] Metals Week. V. 50, No. 52, Dec. 24, 1979, p. 5.

[14] World Mining. V. 31, No. 4, April 1978, p. 104.

[15] European Chemical News. V. 33, No. 907, Oct. 8, 1979, p. 36.

[16] Engineering and Mining Journal. V. 181, No. 3, March 1980, p. 260.

[17] Economic Geology. V. 74, No. 2, May 1979, pp. 448-458.

[18] Bangkok Post in English. Nov. 15, 1979, p. 23.

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The Mineral Industry of Tunisia

By E. Shekarchi[1]

Phosphate rock and crude oil exports, valued at $232 and $430 million respectively, accounted for more than 50% of total exports of Tunisia during the year 1978 and increased somewhat in 1979. Production and export of other mineral commodities such as fluorite, barite, iron ore, lead-zinc, and silver remained at the level of 1977. Phosphate rock production increased 2.7% compared with 1977 output, whereas the production of super and triple superphosphate increased about 6% during the same period. Cement production reached a new high of 882,000 tons in 1978, and with the construction of the fifth cement plant in 1979, Tunisia was planning to satisfy most of the domestic consumption demand by the mid-eighties.

The Tunisian economy rebounded vigorously with overall growth of 8.4% in 1978 and 6.2% in 1979. Despite these performances, major goals set for 1978 by the Fifth Plan (1977-81) were not attained, leading to a review of priorities. Nevertheless, the forward momentum of the Tunisian economy in both years produced a creditable increase in per-capita gross national product (GNP), for example; $987 in 1978 compared with $825 in 1977.

Several major projects were implemented or under study in 1978 and 1979 and merit a brief description because of their impact on development and the economy in general. Implementation of the Miskar offshore gas project, which was estimated to cost about $500 million, was postponed until 1980 because of the need for further cost analysis of gas distribution and shipments of the gas by pipe to overseas markets. Another major energy project was to raise the capacity of Tunisia's only petroleum refinery, at Bizerte, from under 1.5 million tons to 4 million tons annually. Rapid production increases in phosphate were programed, with a goal of 7 million tons of phosphate rock annually by the early eighties. Preliminary studies of this project, expected to cost $60 million, were to begin in early 1980. Another project to upgrade phosphate processing and to increase production of phosphoric acid and fertilizers at Gabes was underway during 1979. Railroad improvements and a new line from Gafsa to Gabes were planned to handle the expanded traffic of the phosphate industry.

PRODUCTION AND TRADE

The trade balance continued in deficit; imports of foodstuffs, agricultural and industrial equipment, and finished goods were all up in 1978. Total imports, rising 17%, reached $2.2 billion. Exports, composed of crude oil, 39%, consumer goods, 24%, foodstuffs, 16%, and miscellaneous, 21% reached $1.2 billion. The annual deficit was covered by long- and medium-term credits, foreign investment, and a grant aid of $17 million. Production and trade information is presented in tables 1, 2, and 3.

Table 1.—Tunisia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978^{p}	1979^{e}
METALS				
Iron and steel:				
Iron ore and concentrate, gross weight ___ thousand tons__	495	344	339	340
Pig iron ________ do____	103	132	134	134
Steel, crude ________ do____	103	156	159	160
Lead:				
Mine output, metal content ________	10,364	10,249	8,009	8,000
Metal:				
Primary[2] ________	19,702	19,200	16,074	16,000
Secondary ________	700	500	500	600
Total ________	20,402	19,700	16,574	16,600
Silver metal, primary ________ thousand troy ounces__	257	236	281	221
Zinc, mine output, metal content ________	7,345	7,081	7,392	7,400
NONMETALS				
Barite ________	23,400	16,049	16,358	16,000
Cement, hydraulic ________ thousand tons__	478	572	882	[3]1,404
Clays, construction ________ do____	195	200	210	220
Fluorspar, chemical grade ________	34,500	28,857	33,258	34,000
Gypsum ________	38,800	^{e}40,000	^{e}40,000	^{e}40,000
Lime, hydraulic ________ thousand tons__	318	338	427	430
Phosphate rock, gross weight ________ do____	3,301	3,615	3,712	3,800
Salt, marine ________ do____	^{r}480	405	425	425
MINERAL FUELS AND RELATED MATERIALS				
Gas:				
Natural:				
Gross ________ million cubic feet__	15,891	25,815	24,438	25,000
Marketed ________ do____	7,554	9,923	9,390	10,000
Manufactured ________ do____	^{e}700	NA	NA	NA
Petroleum:				
Crude ________ thousand 42gallon barrels__	28,600	34,675	36,500	[3]38,113
Refinery products:				
Gasoline ________ do____	1,104	1,199	1,270	1,200
Kerosine ________ do____	833	791	1,267	1,200
Distillate fuel oil ________ do____	2,415	2,536	2,365	2,300
Residual fuel oil ________ do____	3,241	3,383	3,341	3,300
Other ________ do____	649	957	399	600
Refinery fuel and losses ________ do____	790	156	710	400
Total ________ do____	9,032	9,022	9,352	9,000

^{e}Estimate. ^{p}Preliminary. ^{r}Revised. NA Not available.

[1] In addition to the commodities listed, a varity of crude construction materials (common clays, sand and gravel, and stone) is also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] From domestic and imported ores.

[3] Reported figure.

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Table 2.—Tunisia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal destinations, 1976
METALS			
Aluminum metal including alloys, all forms	25	103	Belgium-Luxembourg 51; France 51.
Copper:			
Matte	162	182	France 72; Hungary 61; Belgium-Luxembourg 29.
Metal including alloys, all forms	121	543	Italy 255; Belgium-Luxembourg 195; France 48.
Iron and steel:			
Ore and concentrate	295,611	112,632	Belgium-Luxembourg 110,000.
Metal:			
Scrap	3,571	1,300	Italy 700; Switzerland 600.
Pig iron and ferroalloys	751	--	
Steel, primary forms	2,164	--	
Semimanufactures	4,284	766	Algeria 760.
Lead:			
Ore and concentrate	--	5,859	All to France.
Metal including alloys, all forms	465	20,755	Italy 8,790; Greece 7,005; Algeria 3,125.
Silver metal including alloys troy ounces	83,592	161,139	France 128,989; United Kingdom 32,151.
Zinc:			
Ore and concentrate	8,195	15,586	Italy 8,766; Switzerland 4,000; France 2,820.
Metal including alloys	53	55	France 54.
NONMETALS			
Abrasives, natural	--	2	Libya 1.
Barite and witherite	5,000	4,000	All to Algeria.
Cement	1	(1)	All to Libya.
Chalk	568	164	Do.
Clays and clay products (including all refractory brick):			
Crude	137	15	All to Italy.
Products, nonrefractory	55,616	2,862	All to Libya.
Feldspar and fluorspar	12,050	16,670	All to Italy.
Fertilizer materials:			
Crude, phosphatic	2,053,773	1,961,841	France 536,323; Greece 278,372; Turkey 295,588; Poland 274,480; Czechoslovakia 101,653.
Manufactured:			
Nitrogenous	--	878	Ireland 758; United Kingdom 119.
Phosphatic	238,199	327,589	France 114,078; West Germany 56,540.
Other, including mixed	240,300	16,161	France 6,012; Spain 2,541; Italy 2,100.
Gypsum and plasters	1,366	150	All to Libya.
Lime	1	--	
Pigments, mineral, natural, crude	41	6	All to Libya.
Precious and semiprecious stones, except diamond kilograms	21	423	All to Belgium-Luxembourg.
Salt and brine	197,710	267,490	Italy 55,609; Uruguay 42,000; Norway 36,540.
Stone, sand and gravel:			
Dimension stone, crude and partly worked	399	35	West Germany 13; Italy 2.
Gravel and crushed rock	(1)	17	West Germany 16; Italy 1.
Sand, excluding metal bearing	5	3	West Germany 1; Netherlands 1; Italy 1.
Sulfuric acid, including oleum	11,193	--	
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude thousand 42-gallon barrels	36,692	28,421	Greece 8,450; United States 8,154; Italy 6,457; France 2,132.
Refinery products:			
Gasoline do	2	--	
Kerosine do	923	483	Mainly to bunkers.
Distillate fuel oil do	31	77	Do.
Residual fuel oil do	186	194	Italy 150; bunkers 44.
Lubricants do	2	7	Mainly to bunkers.
Other do	1	16	Italy 14; bunkers 2.
Total do	1,145	777	

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[1] Less than 1/2 unit.

Table 3.—Tunisia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
METALS			
Aluminum metal including alloys:			
Unwrought	3	56	Canada 51.
Semimanufactures	1,609	1,433	Italy 352; France 261; Belgium-Luxembourg 198.
Chromium oxide and hydroxide	11	14	West Germany 13; Netherlands 1.
Copper metal including alloys, all forms	1,858	1,865	France 962; West Germany 316; Belgium-Luxembourg 185.
Gold metal, unworked or partly worked thousand troy ounces	32	20	Switzerland 17; France 2.
Iron and steel metal:			
Scrap	662	1,595	Ivory Coast 1,130; Cameroon 400; France 46.
Pig iron and ferroalloys	990	367	France 278; Netherlands 50.
Sponge iron, powder, shot	73	64	France 58; Italy 5.
Steel, primary forms	6,731	15,307	France 5,861; Italy 5,551; Australia 1,223.
Semimanufactures	130,010	153,056	France 63,488; West Germany 28,289; Belgium-Luxembourg 21,500.
Lead:			
Ore and concentrate	24,089	18,523	Morocco 13,614; Algeria 2,384; Switzerland 2,150.
Oxides	117	144	France 83; West Germany 59.
Metal including alloys, all forms	20	27	France 17; Belgium-Luxembourg 5; West Germany 3.
Magnesium metal including alloys, all forms	2	(1)	Mainly from Italy.
Mercury 76-pound flasks	440	5,887	Mainly from France.
Nickel metal including alloys, all forms	6	13	France 12; Italy 1.
Platinum-group and silver metals including alloys:			
Platinum-group troy ounces	418	257	France 193; West Germany 64.
Silver do	32,697	14,789	France 8,681; Italy 4,726.
Tin metal including alloys, all forms	92	73	Indonesia 24; Malaysia 15; France 14; Belgium-Luxembourg 10.
Titanium oxide	393	391	Italy 128; West Germany 109; France 94; Belgium-Luxembourg 40.
Zinc:			
Oxide	173	204	France 168; Belgium-Luxembourg 28.
Metal including alloys, all forms	1,009	1,086	France 422; Italy 175; Belgium-Luxembourg 120.
Other:			
Ores and concentrates	(1)	1,650	All from Morocco.
Oxides, hydroxides, peroxides of metals	191	534	West Germany 364; France 77; United Kingdom 70.
Base metals including alloys, all forms	47	77	Belgium-Luxembourg 57; Italy 15.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	106	172	France 137; Italy 35.
Grinding and polishing wheels and stones	254	272	Italy 157; France 72.
Asbestos	1,619	1,474	Canada 911; Asia, n.e.s., 150; France 150; U.S.S.R. 150.
Barite and witherite	4,949	8,924	Italy 3,713; Morocco 2,846; France 1,577; Greece 400.
Boron materials:			
Crude natural borates	42	7	Turkey 5; France 2.
Oxide and acid	181	61	Italy 50; West Germany 11.
Cement	527,353	792,951	Spain 302,149; U.S.S.R. 223,227; Yugoslavia 191,656.
Chalk	395	283	Mainly from France.
Clays and clay products (including all refractory brick):			
Crude	18,701	11,032	United Kingdom 3,458; Morocco 2,628; France 1,428.
Products:			
Refractory	7,698	6,678	France 3,409; Morocco 1,205; West Germany 825.
Nonrefractory	24	1	All from West Germany.
Diatomite and other infusorial earth	136	150	France 138.
Feldspar and fluorspar	800	750	Italy 500; France 250.
Fertilizer materials:			
Manufactured:			
Nitrogenous	80,974	71,030	Romania 24,901; Bulgaria 22,044; Poland 18,517.
Phosphatic	(1)	1	All from Netherlands.
Potassic	14,794	4,982	Mainly from Italy.
Other, including mixed	41	5	Mainly from West Germany.
Ammonia	194	6,224	Netherlands 5,501.

See footnotes at end of table.

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Table 3.—Tunisia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
NONMETALS —Continued			
Graphite, natural	3	4	France 3; Algeria 1.
Gypsum and plasters	20	18	Mainly from France.
Lime	([1])	9	Do.
Magnesite	5	6	United States 5; France 1.
Mica, all forms	18	21	Mainly from France.
Pigments, mineral, including processed iron oxides	166	137	West Germany 104; France 18; Spain 15.
Pyrite, gross weight	5,000	([1])	All from France.
Salt and brines	2	9	France 5; United Kingdom 3; West Germany 1.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	7,695	9,899	France 7,894; Spain 905.
Caustic potash and sodic and potassic peroxides	16	17	France 8; West Germany 6; Belgium-Luxembourg 2.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	7,794	9,517	Mainly from Italy.
Worked	94	98	Italy 85.
Dolomite, chiefly refractory grade	121	37	France 27; Italy 10.
Quartz and quartzite	1,004	525	Mainly from Belgium-Luxembourg.
Gravel and crushed rock	6,512	7,744	Italy 7,338.
Sand, excluding metal bearing	30	104	Italy 60; Belgium-Luxembourg 30; France 13.
Sulfur:			
Elemental, all forms	178,982	388,387	Canada 156,892; Iraq 72,770.
Sulfuric acid, including oleum	1,162	664	France 566; Netherlands 77.
Talc, steatite, soapstone, pyrophyllite	2,597	1,591	France 982; Italy 603.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,731	55	Italy 49; France 5.
Coal, all grades, including briquets	52,919	23,229	France 5,722; U.S.S.R. 5,400; Morocco 4,768; Poland 4,470; United Kingdom 2,870.
Coke and semicoke	87,027	84,977	West Germany 44,066; Italy 40,911.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	7,522	8,550	Saudi Arabia 4,348; Iraq 4,123.
Refinery products:			
Gasoline do	3	([1])	All from West Germany.
Kerosine do	1,385	1,689	Greece 1,407; Italy 264.
Distillate fuel oil do	1,231	1,418	Italy 735; Greece 682.
Residual fuel oil do	220	339	Egypt 133; Venezuela 133; Romania 73.
Lubricants do	136	177	Italy 108; France 22; Romania 18.
Mineral jelly and wax do	6	7	West Germany 3; Hungary 2; France 1.
Bitumen do	93	119	Italy 116.
Other do	153	223	Italy 109; Greece 85.
Total do	3,227	3,972	

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Iron and Steel.—Production of iron ore from Djebel, Djerissa, Douaria, and Tamera decreased in 1978 and 1979, owing to exhaustion of the ore bodies. Djerissa mine was the only iron ore deposit for which reserves, about 4 million tons were given. Iron ore production was geared primarily to internal demand; no export programs were planned and investment in iron ore mining was cut from $0.7 million in 1977 to $0.3 million in 1978, with $0.25 million for 1979.

Expansion of Tunisia's only steel mill, El Fouladh, was the only major project foreseen under the current fifth development plan to meet the fast-growing demand, particularly for reinforcing beams, in a booming construction industry. W.S. Atkins and partners, a British firm, conducted a feasibility study and a market projection in Tunisia to determine whether the present plant at Menzel Bourguiba should be expanded or a new plant should be built elsewhere. It was recommended that the present facilities be expanded by 250,000 tons in the first stage and by an additional 180,000 tons in a second stage. Atkins' study indicated that domestic demand for reinforcing bars and medium and light sections will exceed 450,000 tons by 1995. In

1979, El Fouladh officials examined some small size steel manufacturing facilities in Europe, but no concrete decision was made.

Lead and Zinc.—In 1978 and 1979 lead and zinc ore was beneficiated at the mine site. Lead concentrates declined both years owing to exhaustion of the mine. Some of these concentrates were shipped overseas, while the rest were smelted at Megrime. Most of the zinc concentrates were exported. The Société Tunisianne d'Expansion Minére (SOTEMI), the Government-owned mining company, was the only lead-zinc producer in 1978 and 1979. Lead concentrates declined in both years owing to exhaustion of the mine and limited capacity of the beneficiation plant. The efforts of the Geological Survey and the Mines Bureau to locate new deposits have been negative, even though private company geologists have shown interest in developing new findings of lead-zinc mineralization.

Other minerals.—Limited amounts of silver and mercury were produced as byproducts from lead and zinc ores. Some arsenic was produced from the Tabett ben Ksouri deposits, for domestic consumption and limited exports.

NONMETALS

Cement.—Efficiency in cement production to meet domestic demand remained a national priority. In 1978 Tunisia produced about 882,000 tons of cement, which was increased to 1.4 million tons in 1979. The output goal of 1.5 million tons by 1981 remained unchanged. After 1981, Tunisia planned to become an exporter of cement to neighboring countries and perhaps to the Persian Gulf Emirates. To this end the Government allocated $700 million to build new facilities for production of cement. Work on the western cement plant near the Algerian border was completed during 1979, and trial runs were slated for the early 1980's. Construction work on the asbestos cement products plant was completed within the year 1979. This facility with an annual production capacity of 26,000 meters of pipe, primarily for irrigation and sanitation purposes, was to go into full production in 1980. The plant was financed by a group of private, mostly domestic, investors called Ciment-Aminate. A company was formed by the Government called Société Les Ciments Tunisians to administer a cement plant, which was to be built near Jebel Oust with an annual capacity of 1 million tons of cement and 200,000 tons of lime. An international call for bids on the construction of the plant was to be issued by 1980. According to the feasibility study performed by La Forge Conseils et Etudes of Paris, the plant will commence production in 1984 and would cost close to $200 million.

Fertilizer Materials.—Phosphate rock production by the state-controlled Cie. des Phosphates de Gafsa (CPG) rose to 3.7 million tons of concentrate in 1978 and slightly more than that for 1979. The phosphate deposits extend from the Algerian frontier 160 kilometers east into Tunisia. The most important producing mines in this belt were concentrated in the Gafsa basin. Seven underground mines and one open cast mine were operated during 1978 and 1979. Total capacity for rock production in Tunisia by the end of 1979 was 5.6 million tons of ore and 4.6 million tons of concentrates per year. The extended plan of the CPG called for ore handling facilities to be expanded to 10 million tons and concentrator capacity to be increased to 7 million tons annually by 1981. To achieve this expansion in capacity and supply the feedstock, CPG was to increase mining capacity in Sehib and Kef es Schfair. By early 1980, the company expected Kef es Schfair to produce 2.5 million tons of phosphate ore per year, which would make it the largest mine in the basin. Mined material will be processed in the treatment center at Metlaoui, where a new washing plant was under construction in 1979. The Sehib mine was to be the second largest mine in the basin, with an expanded 2-million-ton annual capacity, by the end of 1982. Until 1978 the mined ore from Sehib mine was treated in M'dilla washing plant; however, after 1979 a new treatment plant in the vicinity of Sehib mine was to handle all the ore mined there. The production capacity of the M'dilla mine itself was to be increased to 1.6 million tons by 1981. All other producing mine capacities in 1977 were to be increased in order to reach the goal of 10 million tons of ore set for 1981.

For years about 74% of Tunisian phosphate production consisted of 66% to 68% BPL, and a metallurgical-grade ore came from Kaiaa Khasha. However, owing to generally declining ore grades in the Gafsa Basin, CPG planned an investment in new benefication facilities to upgrade the old treatment plant and increase capacity to handle lower grade ores. The need for ore beneficiated by washing rather than by air-separation units was increasing; therefore, the company installed four new washing

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plants—at Sehib, M'dilla, Moulares, and Metlaoui—which were to be operating by the end of 1980.

Western Europe and Latin America remained the most important export markets, importing Tunisian phosphate rock at a steady level. In contrast to the situation on export markets, domestic deliveries continued to increase and in 1978 reached 1.8 million tons. Tunisia was one of the first of the North African phosphate rock producers to invest in chemical treatment facilities to process its own output. Domestic deliveries to the chemical plants within the country exceeded export sales, accounting for well over half of Tunisia's total sales. By the end of 1979, a new phosphoric acid and diammonium phosphate complex became operational and further increased domestic consumption of rock phosphate over exports. Since this last chemical plant was funded mostly by the Kuwait Fund for Arab Development, it was to be known as Arabe des Engmis Phosphates et Azotes. Also, Industries Chimiques Maghrebines (ICM) was planning to add a third phosphoric acid unit to the existing complex at Gabes in 1980, which would again boost domestic sales of phosphate rock.

Other Nonmetals.—Starting in 1977, most of the fluorspar production of Tunisia was consumed domestically as feedstock for the Industries Chemiques de Fluor's aluminum fluoride plant. During 1978 and 1979 the plant used close to 30,000 tons of fluorite mined at Zriba mine, located 45 kilometers southeast of Tunis. Barite associated with fluorspar also was mined at Zriba; however, owing to the lack of an international or domestic market, it was accumulated in the waste ponds and saved for possible future use at home or abroad. Marine salt production from Sfax, Sousse, and Magrine declined during both 1978 and 1979, because of curtailed demand by the local industry.

MINERAL FUELS

The Government-owned Public Utility Office launched an onshore gas distribution system designed to take natural gas from the Miskar gas field and/or the Algerian-Italian pipeline and distribute it to major industrial consumers along the Bizerte to Gabes coastline, approximately 550 kilometers. Total cost of the project was given at $190 million, and completion was to be by the end of 1981. Engineering studies were carried on during 1978, and a call for bids to supply pipe and related pumps was issued during 1979.

Enterprise Tunisienne des Activities Petroliers (ETAP), the Tunisian state oil company, planned to issue a tender in 1980 for supply and installation of a petroleum products pipeline between Bizerte and La Goulette, about 70 kilometers. The pipeline would convey petroleum products from the refinery in Bizerte to Tunis and its international airport. Also, ETAP, in partnership with Société Tunisienne des Industries de Raffinage (STIR), intended to construct a lubricant reprocessing plant at Bizerte. Plant construction, estimated at $13 million, was to begin in early 1980, with a slated production date of late 1981 or early 1982. Total annual capacity was to be 10,000 tons, and most of the products were to be consumed locally.

A major project of the fifth plan was expansion of Tunisia's only petroleum refinery, at Bizerte. Plans called for an increase of capacity from 1.2 million tons per year to 4 million tons annually. During 1978 execution of this plan was delayed, but detailed engineering work was finished in 1979 and it was indicated that initial expansion work would be started in early 1980. Fuel for the Bizerte refinery was imported primarily from Iraq and Saudi Arabia, while Tunisian crude petroleum was exported, as it was found pricewise economically advantageous. During 1978 and 1979, Bizerte refinery produced at full capacity.

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[1] Supervisory physical scientist, Branch of Foreign Data.

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The Mineral Industry of Turkey

By Candice Stevens[1] and W. Thomas Cocke[2]

Despite substantial mineral resources, the mineral industry was a minor contributor to Turkey's gross national product (GNP) of $51 billion[3] in 1978 and an estimated $55 billion in 1979. Mineral development lagged owing to insufficient exploration, a shortage of capital, and managerial problems. The Government instituted measures to stabilize the economy and provide the basis for economic growth with the mineral sector playing a key role. Increased foreign aid, a new 5-year plan (1979-83), and revised mining and investment codes were to provide the impetus for the Government's industrialization program.

Increased expenditures for oil imports caused successive balance of payments deficits and raised Turkey's foreign debt to over $13 billion in 1978 and higher in 1979. An economic crisis was precipitated by 60% inflation, 25% unemployment, and large production declines owing to the foreign exchange shortage. In 1978, the International Monetary Fund (IMF) approved a $450 million standby loan dependent on the implementation of certain austerity measures which included monetary devaluation, moderation of annual growth rate of GNP to 5%, reduction of deficit spending, reduction of inflation rate, and reduction of foreign trade deficits. A consortium of 18 nations and international organizations was to provide an additional $900 million in emergency relief to help solve the balance of payments problems. The Government in turn introduced provisions for the devaluation of the lira, a reduction in Government spending, increases in prices and interest rates, limitations on credit, and the expansion of investment and export incentives. In August 1979, $2.2 billion of foreign debt was restructured as a prerequisite for a number of financial packages designed to relieve Turkey's hard-pressed economy. In 1979, the IMF cleared the way for massive financial assistance, totaling more than $1.5 billion from official and private sources.

The Fourth 5-Year Development Plan (1979-83) proposed a total investment of $60 billion, of which $4 billion was allocated to the mining sector and $18 billion to the industrial sector. Its goals were an annual growth rate of 8%, an annual increase in export value of 18%, and an increase in industry's share of the GNP from 29% to 32%. In the minerals sector, the emphasis was on increased exports of processed minerals and a decrease in the export of ores and concentrates. The planned annual growth rates for mineral products were 16.5% for iron and steel, 15.3% for fertilizer and petrochemicals, 12.4% for petroleum products, and 11.9% for cement. Increases in processing capacity were also designated for chromite, copper, lead-zinc, and boron. Special attention was to be given to the expansion of lignite production to provide fuel for processing industries and reduce dependence on foreign energy supplies.

In October 1978, the Government passed a new mining law (No. 2172) which authorized the expropriation of private mines deemed essential to the state. Compensation for each mine was to be assessed by an Appraisal Commission which would take into account the value of mineral stocks, installations, machinery and equipment, and land rental. Expropriated properties were to be placed under the direction of the State Economic Enterprises (SEE), industrial and commercial enterprises that produced approximately 15% of Turkey's GNP and employed 40% of the nonagricultural workers of the country. In November 1978, the Government nationalized private mines for lignite, iron ore, and boron which were being operated under 650 exploration and/or exploitation permits.

The Government was further revising the Foreign Investment Encouragement Law (No. 6224) in order to eliminate bureaucratic barriers to foreign investors. The law would allow foreign companies to hold a majority equity in Turkish ventures, and, in certain cases, would allow foreign companies to hold 100% equity in export-oriented operations. Guarantees for profit and capital repatriation and for the employment of foreign personnel were also included in the law.

Maden Tetkik ve Arama Enstitusu (MTA), the Mineral Research and Exploration Institute, was responsible for exploration and evaluation of the country's mineral resources. Surveys were being conducted of the eastern Provinces which contained substantial reserves of lignite at Elbistan, petroleum at Batman, and iron ore at Divrigi. The SEE agency responsible for the operation of most mines and wells in the public sector was Etibank Genel. Mudurlugu, which had under its jurisdiction more than 38 commodities including copper, chromite, bauxite, and aluminum. It was estimated that in 1978 the Government owned 80% of the country's metallic ore reserves and 40% of the nonmetallic ore reserves.

PRODUCTION AND TRADE

As shown in table 1, Turkey produced a variety of metals, nonmetals, and mineral fuels. Production was generally at low levels, about 60% capacity, owing to a lack of foreign exchange, inadequacy of demand, shortage of raw materials, and power cuts due to electricity shortages. Ferrous metal production, including iron and steel and chromite, was valued at $1.6 billion in 1978. Nonferrous metal production, including bauxite, copper, and lead-zinc, was valued at $660 million. The production of nonmetallic minerals, of which boron was the most significant, was valued at $80 million. Coal, petroleum, and other fuel production was valued at $600 million.

Turkey experienced balance-of-trade deficits of $2.3 billion in 1978 and in 1979 owing primarily to fuel imports, although the deficits were down nearly 50% from 1977. The Government instituted measures to promote industrial exports including tax incentives, streamlined export licensing procedures, and foreign exchange remittances to exporting companies. Mineral exports were 6% of total exports in 1978. Boron ($60 million), chromite ($35 million), and iron and steel ($20 million) were the principal mineral exports. Mineral exports were valued at about $135 million.

Turkey imported mostly raw materials and capital goods as inputs to domestic industry. Phosphate rock and iron and steel were the leading nonfuel mineral imports. Turkey imported approximately 80% of its crude and refined petroleum requirements.

Table 1.—Turkey: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^{p}	1979^{e}
METALS				
Aluminum:				
Bauxite	461,040	667,200	453,600	350,000
Alumina	138,732	^{e}169,700	^{e}84,500	140,000
Metal	35,500	51,300	^{e}32,000	32,000
Antimony:				
Ore, mine output:				
Gross weight	34,309	38,423	47,409	50,000
Metal content	^{r}1,715	1,921	2,370	2,400
Regulus	91	61	NA	NA
Chromite:				
Gross weight (34%-43% Cr_2O_3)	^{r}946,535	952,422	651,148	600,000
Salable product	^{r}580,358	508,357	^{e}375,000	450,000
Copper:				
Mine output, metal content	29,851	33,431	^{e}31,250	24,300
Metal:				
Smelter	27,672	31,524	26,195	^{p}22,300
Refined	^{r}28,300	25,300	30,100	^{p}22,300
Iron and steel:				
Iron ore, gross weight thousand tons	3,605	3,470	3,568	3,000

See footnotes at end of table.

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Table 1.—Turkey: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS —Continued				
Iron and steel —Continued				
Metal:				
Pig iron and ferroalloys:				
Ferrochromium[e]	[r]25,400	[r]35,380	39,900	50,000
Pig iron and other ferroalloys ___ thousand tons	1,992	1,728	[e]1,680	2,302
Crude steel, including castings ___ do	1,457	1,397	1,510	2,400
Lead:				
Mine output, metal content[3]	4,926	[r] [e]8,718	9,500	20,000
Metal, smelter	3,200	3,000	3,000	3,000
Manganese ore, gross weight	[r]16,960	19,300	[e]20,000	30,000
Mercury ___ 76-pound flasks	4,899	4,686	5,020	5,000
Silver, mine output, metal content ___ thousand troy ounces	[e]220	[e]220	219	250
Tungsten, mine output, metal content	928	[e]1,000	7	65
Zinc:				
Mine output, metal content[e] [3]	42,750	67,100	40,700	46,000
Metal, smelter, primary	2,300	20,900	20,000	24,000
NONMETALS				
Abrasives, natural: Emery	67,342	66,018	55,620	55,000
Asbestos	9,941	3,975	13,372	10,000
Barite	188,266	143,510	32,031	45,000
Boron materials ___ thousand tons	912	1,099	1,320	900
Cement, hydraulic	12,342	13,833	15,129	[1]13,788
Clays:				
Bentonite	23,560	4,357	8,280	14,000
Kaolin	55,611	59,162	43,685	59,000
Other	85,753	67,854	402,440	400,000
Diatomite	8,500	9,000	9,000	9,000
Feldspar	57,800	75,200	75,300	72,600
Fluorspar	1,282	1,711	1,253	1,300
Gypsum	32,308	65,327	60,332	63,500
Magnesite, crude ore	409,276	516,162	417,201	530,000
Meerschaum ___ kilograms	12,600	4,150	3,050	3,000
Nitrogen, N content of ammonia ___ thousand tons	[e]90	107	217	225
Perlite	24,546	30,000	26,861	27,000
Phosphate rock	67,000	65,418	32,205	35,000
Pyrite, cuprous, gross weight	84,630	38,332	[e]200,000	200,000
Salt, all types ___ thousand tons	579	777	929	900
Sodium compounds:				
Sodium carbonate[e]	55,000	60,000	65,000	70,000
Sodium sulfate	87,907	72,917	64,271	60,000
Stone, sand and gravel, n.e.s.:				
Limestone ___ thousand tons	16,295	19,121	22,069	20,000
Marble	113,700	118,600	122,000	120,000
Quartzite	196,276	234,643	243,210	240,000
Sand, siliceous	28,936	27,636	67,307	60,000
Strontium minerals: Celestite	6,400	16,600	17,500	18,000
Sulfates, natural, n.e.s.: Aluminum sulfate (alunite)	[r]8,250	6,402	[e]6,000	6,000
Sulfur:				
Native, other than Frasch	21,000	20,040	28,000	30,000
S content of pyrite	38,337	17,552	[e]90,000	90,000
Byproduct	69,000	80,000	[e]80,000	80,000
Total	128,337	117,592	198,000	200,000
MINERAL FUELS AND RELATED MATERIALS				
Asphalt, natural ___ thousand tons	463	434	297	320
Carbon black	14,100	15,808	12,254	12,000
Coal:				
Bituminous ___ thousand tons	[r]4,632	4,405	4,377	4,000
Lignite ___ do	[r]8,252	9,807	[e]10,350	12,000
Coke and semicoke:				
Metallurgical ___ do	[r]1,824	1,740	1,690	1,700
Gashouse[e] ___ do	[r]472	[r]340	270	300
Breeze ___ do	139	[e]135	[e]125	125
Total ___ do	[r]2,435	2,215	2,085	2,125
Gas:				
Natural:				
Gross ___ million cubic feet	[r] [e]35,100	[r] [e]36,700	36,500	36,000
Marketed ___ do	[r] [e]750	[r] [e]785	794	800
Manufactured (from coal gas plants) ___ do	4,792	4,752	[e]4,800	NA
Petroleum:				
Crude ___ thousand 42-gallon barrels	18,392	19,428	19,595	20,000

See footnotes at end of table.

Table 1.—Turkey: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978p	1979e
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products:				
Gasoline thousand 42-gallon barrels	16,660	19,848	17,083	17,200
Jet fuel do	1,424	1,544	1,367	1,400
Kerosine do	4,030	4,621	4,474	4,500
Distillate fuel oil do	24,573	25,232	63,168	64,100
Residual fuel oil do	35,771	42,671		
Lubricants do	903	1,142	1,366	1,400
Other:				
Liquefied petroleum gas do	4,025	4,487	4,241	4,300
Naphtha do	3,230		131	130
Petroleum asphalt do	1,736	5,580	2,615	2,600
Unspecified do	714		2,672	2,700
Refinery fuel and losses do	4,088	4,345	3,454	3,500
Total do	97,154	109,470	100,521	102,000

eEstimate. pPreliminary. rRevised. NA Not available.

[1] Reported figure.

[2] Includes Pb content of lead and lead-zinc ores but excludes Pb content of zinc ore.

[3] Includes Zn content of zinc and lead-zinc ores but excludes Zn content of lead ore.

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Table 2.—Turkey: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal destinations, 1976
METALS			
Aluminum:			
Ore and concentrate	75,000	11,160	All to Romania.
Oxide and hydroxide	36,657	NA	
Metal including alloys, semimanufactures	3,092	8,556	Saudi Arabia 2,742; Kuwait 2,109; Syria 1,384; Iran 924; Iraq 844.
Antimony:			
Ore and concentrate	1,776	NA	
Metal including alloys, all forms	205	NA	
Arsenic, natural sulfides	5	NA	
Copper metal including alloys:			
Unwrought	5,540	NA	
Semimanufactures	100	NA	
Chromium ore and concentrate	648,484	608,435	Switzerland 109,707; United States 107,107; Italy 90,917; Japan 63,129.
Iron and steel metal:			
Ferroalloys	6,364	8,050	Netherlands 2,650; United Kingdom 1,750; Belgium-Luxembourg 1,175; Romania 800.
Semimanufactures	14,499	24,067	Syria 12,746; Iran 3,096; Iraq 2,575.
Lead ore and concentrate	6,625	9,450	United Kingdom 4,000; Switzerland 3,600.
Mercury 76-pound flasks	96	NA	
Molybdenum ore and concentrate	18	NA	
Tungsten ore and concentrate	9	NA	
Zinc ore and concentrate	51,548	25,952	Italy 11,302; Belgium-Luxembourg 7,150; Bulgaria 5,500.
Other:			
Ores and concentrates	--	2,795	Yugoslavia 995; West Germany 900; Belgium-Luxembourg 600; Italy 300.
Metals including alloys, all forms	--	347	Bulgaria 275; Netherlands 35.
NONMETALS			
Abrasives, natural, n.e.s	58,719	49,932	France 32,869; United Kingdom 11,187; Netherlands 5,875.
Barite	35,406	NA	
Boron materials:			
Crude natural borates	39,215	NA	
Oxide and acid	7,247	NA	
Cement thousand tons	848	566	Syria 237; Libya 114; Iran 97.
Chalk	3,296	NA	
Clays and clay products:			
Crude:			
Bentonite	10,200	NA	
Kaolin	1,506	NA	
Other	30	NA	
Products:			
Refractory	325	17	NA.
Nonrefractory	59	789	Saudi Arabia 571.
Diatomite and other infusorial earth	160	NA	
Gypsum	1,500	NA	
Lime	878	6,150	Saudi Arabia 3,913.
Magnesite:			
Crude	14,650	NA	
Calcined	63,648	NA	
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked, calcareous	12,025	14,287	Italy 5,126; Syria 4,328, West Germany 2,268.
Worked	6	NA	
Dolomite	30	NA	
Talc	179	NA	
Other:			
Crude: Meerschaum, amber, jet	12	NA	
Unspecified	16,652	NA	
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets	200	NA	
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	2,026	660	West Germany 176; United Kingdom 168; Sweden 153; Belgium-Luxembourg 128.
Kerosine and jet fuel do	659	475	Netherlands 301; Lebanon 136.
Other do	1	NA	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	126,858	151,475	Italy 54,637; France 39,138; Belgium-Luxembourg 19,773; Netherlands 19,647; Portugal 18,279.

NA Not available.

Table 3.—Turkey: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976[1]	Principal sources, 1976
METALS			
Aluminum:			
Oxide and hydroxide	1,184	NA	
Metal including alloys:			
Scrap	395	NA	
Unwrought	51,681	26,861	Canada 11,148; Switzerland 4,212; Norway 2,891.
Semimanufactures	2,659	3,202	Yugoslavia 1,151; Sweden 764.
Arsenic trioxide, pentoxide, acids	90	NA	
Cadmium metal including alloys, all forms	19	NA	
Chromium oxide and hydroxide	243	NA	
Cobalt:			
Oxide and hydroxide	17	NA	
Metal including alloys, all forms	1	NA	
Copper:			
Ore and concentrate	2	NA	
Metal including alloys:			
Scrap	498	240	Yugoslavia 146.
Unwrought	1,275	5,155	United Kingdom 2,983; Bulgaria 1,997.
Semimanufactures	5,725	6,960	Italy 1,963; Belgium-Luxembourg 1,958; West Germany 1,815.
Iron and steel:			
Ore and concentrate thousand tons	234	413	India 159; Brazil 130; Puerto Rico 105.
Metal:			
Scrap do	85	286	Puerto Rico 115; Switzerland 71; West Germany 25.
Pig iron, ferroalloys, similar materials do	134	116	Switzerland 29; West Germany 19; United Kingdom 19; Japan 11.
Steel, primary forms do	739	761	West Germany 166; Switzerland 162; Japan 157; Bulgaria 74.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	504	212	West Germany 96; Switzerland 30.
Universals, plates, sheets do	280	55	Japan 29; West Germany 10; Bulgaria 8.
Hoop and strip do	5	6	Japan 3; Austria 1; France 1; West Germany 1.
Rails and accessories do	18	7	United Kingdom 5; West Germany 1; Yugoslavia 1.
Wire do	9	3	West Germany 2; Japan 1.
Tubes, pipes, fittings do	117	113	France 33; West Germany 25; Italy [illegible]; Japan 11.
Castings and forgings do	1	2	France 1; Italy 1.
Total do	934	398	
Lead metal including alloys:			
Scrap	2,069	1,286	All from Puerto Rico.
Unwrought	4,724	7,468	Yugoslavia 3,798; United Kingdom 2,640; Bulgaria 847.
Semimanufactures	270	1,422	Mainly from Japan.
Magnesium metal including alloys:			
Unwrought	161	[2]175	Norway 124.
Semimanufactures	3	--	
Manganese:			
Ore and concentrate	4,852	3,130	All from Belgium-Luxembourg.
Oxides	823	NA	
Metal	61	NA	
Nickel:			
Matte, speiss, similar materials	332	384	United Kingdom 236; Netherlands 111.
Metal including alloys, unwrought and semimanufactures	181	155	West Germany 85; United Kingdom [illegible]; France 14.
Platinum-group and silver metals including alloys:			
Platinum-group troy ounces	611	NA	
Silver do	140,756	NA	
Tin:			
Oxides	22	NA	
Metal including alloys, all forms	1,182	901	United Kingdom 313; Netherlands [illegible]; Belgium-Luxembourg 181.
Titanium:			
Ore and concentrate	2,132	NA	
Oxides	2,035	NA	
Zinc:			
Oxide	2,505	NA	
Metal including alloys:			
Scrap and blue powder	130	488	Canada 250; Belgium-Luxembourg [illegible].
Unwrought	17,384	23,450	West Germany 7,516; Belgium-Luxembourg 5,455; Switzerland [illegible].
Semimanufactures	961	1,433	Yugoslavia 682; Belgium-Luxembourg 403; France 186.
Zirconium ore and concentrate	37	NA	

See footnotes at end of table.

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Table 3.—Turkey: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976[1]	Principal sources, 1976
METALS —Continued			
Other:			
Ores and concentrates	--	2,477	Austria 1,048; Australia 649; United Kingdom 453; Netherlands 285.
Ash and residue containing nonferrous metals	440	NA	
Oxides, hydroxides, peroxides of metals	161	NA	
Metals:			
Alkali, alkaline-earth, rare-earth metals	1	NA	
Base metals including alloys, all forms, n.e.s	8	247	Norway 124.
NONMETALS			
Abrasives, natural, n.e.s.:			
Crude	(3)	NA	
Dust and powder of precious and semiprecious stones kilograms	1,907	NA	
Grinding and polishing wheels and stones	585	532	West Germany 225; Italy 83; United Kingdom 59.
Asbestos, crude	16,357	19,681	U.S.S.R. 7,383; Canada 3,737; West Germany 2,916.
Cement	1,811	528	NA.
Chalk	92	NA	
Clays and clay products:			
Crude:			
Bentonite	27	NA	
Kaolin	5,334	NA	
Other	324	5,999	Puerto Rico 4,545; United Kingdom 620.
Products:			
Refractory (including nonclay brick)	33,016	47,211	U.S.S.R. 18,435; Austria 7,575; West Germany 6,268; Puerto Rico 5,827.
Nonrefractory	66	285	West Germany 214; France 68.
Diamond, gem and industrial value, thousands	$772	$40	Netherlands $20; United Kingdom $14.
Diatomite and other infusorial earth	232	NA	
Feldspar	85	NA	
Fertilizer materials:			
Crude:			
Nitrogenous	--	19,619	Romania 11,263; Austria 5,776; Switzerland 2,580.
Phosphatic	905,267	793,112	Morocco 283,279; Tunisia 255,572; Jordan 161,179; Israel 82,778.
Manufactured:			
Nitrogenous	173,610	922,425	Romania 268,279; Italy 148,701; Austria 104,974.
Phosphatic	1,384	NA	
Potassic	5	18,740	Puerto Rico 7,710; France 7,677; Liberia 3,200.
Other	86,027	173,407	Puerto Rico 100,206; France 39,084; Switzerland 34,116.
Fluorspar	160	NA	
Graphite, natural	573	NA	
Gypsum	2	NA	
Lime	83	NA	
Mica:			
Crude	104	NA	
Worked	29	55	Spain 40.
Pigments, mineral:			
Iron oxides, processed	210	NA	
Other	5	NA	
Precious and semiprecious stones, except diamond kilograms	4,675	NA	
Pyrite, gross weight	100,453	19,605	Cyprus 18,407.
Salt	25	41,613	Mainly from Jordan.
Sodium and potassium compounds:			
Caustic soda	24,276	NA	
Caustic potash	829	NA	
Stone, sand and gravel:			
Gravel and crushed rock	339	NA	
Quartz and quartzite	421	NA	
Sand, excluding metal bearing	2	NA	
Sulfur:			
Elemental:			
Other than colloidal	2,004	6,475	Switzerland 3,150; Lebanon 1,888; Belgium-Luxembourg 837.
Colloidal	634	NA	
Sulfuric acid	354,792	NA	
Talc	410	NA	
Vermiculite	20	NA	
Other:			
Crude	636	1,819	West Germany 1,124.
Oxides and hydroxides of magnesium, strontium, barium	194	NA	

See footnotes at end of table.

Table 3.—Turkey: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976[1]	Principal sources, 1976
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	50	NA	
Carbon black	5,234	NA	
Coal, including briquets	26,161	248,942	Mainly from Puerto Rico.
Coke	--	19,790	Netherlands 7,877; Italy 6,968; Belgium-Luxembourg 4,945.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	66,283	172,087	Iraq 53,997; Libya 20,774.
Refinery products:			
Gasoline do	72	286	Romania 229; Italy 57.
Kerosine and jet fuel do	2	NA	
Distillate fuel oil do	510	681	Romania 343; Yugoslavia 337.
Residual fuel oil do	3,122	4,353	Venezuela 939; Romania 747; Bulgaria 731; U.S.S.R. 522; Italy 436.
Lubricants do	706	259	West Germany 59; United Kingdom 58; United States 56; Netherlands 34; Romania 31.
Other:			
Liquefied petroleum gas do	1,512	(4)	NA.
Mineral jelly and wax do	49	54	West Germany 22; Hungary 8; Israel 7; Romania 6.
Unspecified do	3	89	Puerto Rico 65; West Germany 24.
Total do	5,976	5,722	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	28,718	1,808	Netherlands 1,481.

NA Not available.

[1] Commodity Trade Statistics, 1976.

[2] Includes some beryllium.

[3] Less than 1/2 unit.

[4] Value only reported at $31,900.

COMMODITY REVIEW

METALS

Aluminum.—Etibank was the sole producer of bauxite in Turkey with an annual production capacity of 700,000 tons. Bauxite deposits were located principally in the Seydiseher District of Antalya Province, but bauxite was also mined in Western Anatolia on the Aegean coast near Mugla. The country's total bauxite reserves were estimated at 264 million tons assaying 42% Al_2O_3.

The Seydisehir Aluminum Complex operated at half capacity during 1978 owing to shortages of electricity and also of imported caustic soda. Designed and constructed by the Soviet Union, the plant had a production capacity of 460,000 tons per year of raw bauxite to produce a maximum of 200,000 tons per year of alumina and 60,000 tons per year of aluminum products. Negotiations were proceeding with the Soviet Union for doubling the plant's capacity by 1982.

The Milas Bauxite Works near Mugla had a production capacity of 150,000 tons per year of diaspore-type bauxite. The hardness of the ore made crushing difficult and limited sales.

Bazik Refractories Ltd. had a 3,000-ton-per-year-capacity refractory bauxite deposit to the northeast of Istanbul and a small high-alumina refractory brick plant nearby.

Antimony.—Ozdemir Antimuan Madenleri A.S. remained Turkey's largest producer of antimony from its Turhal mine in Tokat Province. Annual capacity was 40,000 tons of ore. The Turhal Works included a facility to produce 63% antimony concentrates. Reserves at Tokat were estimated at 400,000 tons of 14% antimony ore.

Etibank contracted Tectomin (Italy) to construct a 2,600-ton-per-year-capacity anti-

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mony plant at Balikesir. Reserves in the area were established at 305,000 tons of ore averaging 5% to 6% antimony. Etibank also converted the Halikoy mercury smelter into a 500-ton-per-year antimony smelter in response to decrease in world demand for mercury.

MTA continued its evaluation of antimony deposits in the Balikesir and Aydin regions. Turkey's total reserves were estimated at 2.4 million tons.

Chromite.—Turkey was ranked as the world's fourth largest producer of chromite. Chromite deposits occurred in 40 of the country's 67 Provinces, but generally in two east-west belts. Reserves in the major producing areas of Guleman, Mugla, and Eskisehir totaled 5 million tons of high-grade metallurgical ore averaging 48% Cr_2O_3. Etibank's Eastern Chromite Works in the Guleman area had an annual capacity of 250,000 to 300,000 tons of ore, which was processed to 48% Cr_2O_3 concentrates. The Uckopru Chromite Works near Mugla had a capacity of 80,000 tons per year of lumpy ore and 20,000 tons per year of concentrates. Problems at the Kefdag concentrator were solved, and production continued satisfactorily.

About two-thirds of Etibank's production was delivered to the state's two ferrochrome plants. The Elazig Ferrochromium Works, located near Mardin, reached full production of 50,000 tons per year of high-carbon ferrochrome in 1978. Capacity was to be doubled by the addition of two electric furnaces. The Antalya Ferrochromium Works produced 10,000 tons per year of low-carbon ferrochrome, 90% of which was exported. Production at the Antalya plant changed from ferrochrome in 1978 to ferrosilicon.

The largest private chromite producer was Egemetal Madencilik AS, which had 150,000 tons per year capacity. The company, which is associated with Metallgesellschaft (Federal Republic of Germany), is not only a chromite producer, but also acts as a clearinghouse for the small Turkish chromite producers. Turk Maadin Sirketi, a subsidiary of Metallurg Inc. (U.S.), had a production capacity of 150,000 tons per year of concentrates from its mines at Kavak near Eskisehir and Goeck in Mugla Province. Other private producers were Sitki Koeman, Fethiye Maden, and Bilgin Maden Ltd., each with 60,000 tons per year capacity.

Copper.—Turkey's two copper producers were Etibank and Karadeniz Bakir Isletmeleri (KBI), owned 49% by Etibank. Production was centered in three major districts: Murgul, Ergani, and Kure. Reserves were estimated at 250 million tons of ore grading 1% to 4% copper.

The Murgul District was estimated to contain reserves of 150 million tons of copper-pyrite ore. Etibank's Murgul Copper Works had a mine production capacity of 1 million tons of ore per year. The mill and smelter production capacity is 40,000 tons per year of 18% copper concentrates and 10,000 tons per year of blister copper. The project to increase blister copper production by 10,500 tons was almost complete. KBI's two open pit mines in the Murgul District, Cakmakkaya and Damar, had a combined production capacity of 3.7 million tons of ore per year. KBI planned to increase production at its Cakmakkaya concentrator to 180,000 tons per year of 17% copper concentrates from the present capacity of 20,000 tons per year.

The Ergani District was estimated to contain reserves of 20 million tons of copper-pyrite ore. Etibank's mine-mill-smelter complex at Ergani had an annual production capacity of 1 million tons of ore, 70,000 tons of 14% copper concentrates, and 25,000 tons of blister copper. Pyrite concentrates were produced as a byproduct.

The Kure District near the Black Sea coast had reserves of 20 million tons of copper-pyrite ore. Both Etibank and KBI operated mines in the area. Etibank's Kure Cuprous Pyrite Works mined the Asikoy open pit mine at the rate of 1 million tons of ore per year. KBI mined the Bakibaba underground mine at a parallel rate at its Black Sea Copper Works. KBI's new smelter at Samsun had an annual capacity of 40,000 tons of blister copper and 365,000 tons of sulfuric acid. It never attained designed output, and to carry the continuing burden of its financial losses, it was nationalized. Etibank and KBI planned a joint venture to construct a concentrator and smelter complex in Kure with an annual capacity of 120,000 tons of blister copper by 1981.

Etibank's objective in the copper industry was to reach blister copper production capacity of 60,000 tons per year by 1982 and 125,000 tons per year by 1985. Investment planned in existing and new projects was aimed at these targets. The Integrated Copper Project at Kure was expected to add 35,000 tons per year. Development of the Rize-Cayeli deposit, where reserves of 30 million tons were delineated, began in 1979. Production of 65,000 tons per year of blister copper was to begin in 1985.

Iron Ore.—The state-owned Turkish Iron and Steel Works produced approximately half of total iron ore production, and the Government share of iron ore output was expected to increase as steps were taken to nationalize several of the smaller iron producers. The demand for iron ore was expected to increase to 18 million tons per year by 1982. The country's reserves were estimated at 870 million tons with an overall average iron content of 52%.

The largest supplier of directly chargeable iron ore for the steel industry was the Divrigi mine, located in Sivas-Malatya Province. Reserves at Divrigi were estimated at 300 million tons averaging 52% to 58% iron. Turkish Iron and Steel Works planned to expand production capacity from 2.5 million tons per year in 1978 to 5.2 million tons per year in 1980. The Divrigi Concentration and Pelletizing Plant had an annual capacity of 1.4 million tons of 67% iron pellets and 2 million tons of sintering concentrates containing 64% iron.

The Government planned to conduct feasibility studies for exploiting the Hasancelebi iron deposit, located southwest of Divrigi. Reserves were estimated at 300 million tons of low-grade magnetite ore ranging from 28% to 48% iron. It was expected that the Hasancelebi deposits would begin producing in 1984 at the rate of 1.5 million tons per year, increasing to 3 million tons by 1985.

Iron and Steel.—The Government nationalized the import of iron and steel products, which averaged 2 million tons per year. Plans were made for the expansion of production capacity and the construction of new steel mills. Iron and steel production was far below that programmed for 1979, and the Government offered premiums of 1% for meeting individual production goals. Lack of sufficient production of electricity was a major factor.

Turkish Iron and Steel Works produced about 60% of the total steel production at its two plants at Karabuk and Iskenderun. The Karabuk plant, located 175 kilometers north of Ankara on the Black Sea coast, had a production capacity of 600,000 tons per year. The Iskenderun plant, located in southern Turkey near the Syrian border, had an annual production capacity of 1 million tons. The Iskenderun facility was built with technical assistance from the Soviet Union and began production in 1976. Tremendous problems existed at the facility which required Turkish Army troops to maintain peaceful operation. The workforce ballooned to twice that designed, but production stood at less than 25% of capacity by 1980. Shortages of coking coal also complicated progress toward reaching designed production capacity, which was to be doubled by 1982.

Eregli Demir ve Celik Fabrikalari A.S. (ERDEMIR) operated the private steel mill at Eregli on the Black Sea coast. The Eregli facility used iron ore from Divrigi and coal from the Zonguldak coal district. In 1978, a loan was received from the International Bank for Reconstruction and Development to expand capacity from 800,000 tons per year to 1.6 million tons per year.

Izmir Metalurji Fabrikasi T.A.S. (METAS) was conducting feasibility studies for the construction of a direct reduction steel complex at Izmir. METAS produced reinforcing rods and bars from scrap metal. The proposed facility would use coal fuel to produce an initial 400,000 tons per year of steel.

Lead-Zinc.—Etibank accounted for about 40% of lead-zinc production. Four private producers accounted for the remainder of output. Turkey's total reserves were estimated at 5 million tons of lead-zinc ore.

Etibank's Keban Lead and Zinc Works milled a capacity of 40,000 tons per year of ore averaging 6.4% zinc and 4.5% lead. Lead and zinc concentates were produced in a small flotation plant at Keban, located west of Elazig.

Cinko-Kursun Metal Sanayii AS (CINKUR), owned 47% by Etibank, mined lead-zinc ore in Zamanti. Reserves in the area were estimated at 3.5 million tons of high-grade ore. CINKUR's smelter at Kayseri, which came onstream in 1977, operated at 25% capacity in 1978. The plant was designed to process 238,000 tons per year of mixed ore and to produce 40,000 tons of zinc, 6,000 tons of lead, and 120,000 ounces of silver.

The three other producers were Rasih ve Ihsan at Akdagmadeni, Selim Budin Ltd. at Kalekoy, and Karamanci Sirketin in the Zamanti Valley.

Manganese.—Manganese ore in Turkey was mined principally for metallurgical applications, with only minor amounts of nonmetallurgical grade. Unimin Madencilik Sanayi ve Ticaret A.S. had a production capacity of 3,000 tons per year of battery-grade ore. Production was kept low as the pyrolusite ore had to be hand-sorted.

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installation of a magnetic separation unit to boost capacity to 7,500 tons per year was being considered.

Tungsten.—The major tungsten mineralization, occurring in skarns near the contact zones of acid intrusives, was found at Uludag near Bursa, but many similar contacts occur elsewhere and were being explored. Ore reserves at Uludag were reportedly over 16 million tons grading 0.5% WO_3.

Etibank and Metallgesellschaft (Federal Republic of Germany) constructed a concentrator at Uludag for extraction of tungsten by the dry cycle system. Production, long delayed due to technical difficulties and fire, began in the last quarter of 1978. Around 400 to 500 tons per day of ore were processed yielding 45% to 50% purity in concentrated ore. Mine production was advancing toward 1,000 tons per day in 1979 with the implementation of a ring-blasting technique replacing the costly longwall method previously used. Full production was to begin in 1980 at the design rate of 1,750 tons per day. All production was to be exported, and small shipments of tungsten were made to Japan and West Germany.

NONMETALS

Asbestos.—Asbestos production in Turkey was confined mainly to the amphibole varieties; however, Amyant Sanayi A.S., a subsidiary of Unimin, had a deposit of tremolite. Production capacity was 30,000 to 40,000 tons per year, but owing to low demand for tremolite asbestos, production from the mine and plant near Eskisehir was confined to about 3,000 tons per year.

Other producers of asbestos included Bilfer Maden Ltd. Sirketi (5,000 tons per year), Ozgur Atermit Sanayi ve Ticaret A.S. (150 tons per year), and Sark Amyant Isletmesi (1,300 tons per year).

Barite.—The production of barite increased owing to the opening of new processing facilities. Deposits of barite are known in nine scattered localities in Turkey and contain reserves estimated at 33 million tons. The important producing regions were Mus, Alanya, and Konya.

Bastas Barytes Industry and Trading Co. Inc. has deposits with production capacity of 150,000 tons per year at Alanya and Sarikaraagac. A grinding plant with 120,000 tons per year capacity was opened in Antalya in February.

Until 1978, Barit Maden Turk A.S. was the largest single producer of barite in Turkey. Approximately 50,000 tons per year were mined from the deposits near Maras. Barit Maden expanded capacity at its processing plant in Adana to 70,000 tons per year in 1978.

Etibank produced small quantities of barite. Etibank was constructing a grinding plant at Beysehir to comply with the current export regulations which permitted only ground barite to be exported.

Polbar Baryte Industries A.S. had a production capacity of 40,000 tons per year from its mines near Alanya. Construction of a 50,000-ton-per-year grinding plant was underway. Production capacity at the mines was to be increased in line with the grinding capacity.

Baser Maden Sanyii ve Ticaret A.S. operated a 60,000-ton-per-year barite mine at Sarkikaraagac. An extension to the grinding plant was underway to increase capacity to 80,000 tons per year.

Kimya Tesisleri Sanayi ve Ticaret A.S. (Kimtes) shut down its grinding plants at Yarimca and Kocaeli in 1978 to expand and totally reorganize operations. In July 1979, the company resumed production with a total capacity of 100,000 tons per year. Kimtes operated mines at Silifke (20,000 tons per year) and Kutahya (10,000 tons per year).

A new intergrated mine and grinding plant was being brought onstream by Emas Industrial Minerals A.S. at Mus. Only limited production was possible at the 60,000-ton-per-year-capacity plant in 1979 owing to a delay in electrical power connection. Full production was to begin in 1980.

Other barite producers were Dolsan Dolga Maddeleri Sanayii Kollektif Sirketi (35,000 to 40,000 tons per year), Durmus Yasar ve Ogullar (12,000 tons per year), Egemetal Madencilik (10,000 tons per year), and Kale Madenicilik (1,000 tons per year).

Boron.—After the United States, Turkey was the world's most important source of boron as it accounted for almost one-third of total world production. Etibank accounted for about 60% of the country's boron production in 1978. Under the Government's nationalization decrees, Etibank took over all mines except the Emet mine in 1979. Turkey, with 500 million tons of boron minerals assaying 25% B_2O_3, possessed more than half of the world's known reserves. Almost all production was exported, in either crude or processed form, from the port of Bandirma on the Sea of Marmara.

Boron was mined in three major districts in northwest Turkey: Kirka, Bigadic, and Emet. Etibank mined 750,000 tons per year

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of tincal at Kirka in Eskisehir Province. About 100,000 tons per year of colemanite and ulexite was mined at Bigadic in Bilakesir Province. Total capacity at Emet in Kutahya Province was 60,000 tons per year of colemanite.

The Emet Colemanite Works upgraded colemanite from Hisarcik and Espiye to produce 500,000 tons per year of concentrates averaging 40% to 47% B_2O_3. The Etibank facility at Kirka upgraded tincal to produce 400,000 tons per year of 35% B_2O_3 concentrates. A refinery was under construction at Eskisehir to process tincal concentrate into sodium borate compounds. Design capacity of the $63 million plant was to be 180,000 tons per year of borax pentahydrate, 17,000 tons per year of refined anhydrous borax, and 6,000 tons per year of refined decahydrate borax. A 150,000-ton-per-year colemanite plant was also under construction in the Balekesir region Expansion of the Bandirma Borax and Acid Works on the Sea of Marmara was planned to increase capacity of boric acid from 35,000 to 135,000 tons per year, sodium borate from 20,000 to 40,000 tons per year, and refined decahydrate borax from 55,000 to 70,000 tons per year.

There were five other producers of colemanite. The Mortas-Bortas Group had mines at Bigadic, Emet, and Mustafa Kamal Pasa. Rosih ve Ihsan A.S., a subsidiary of Pechiney Ugine Kuhlmann (France), and Suyakei Pazarlama Ticaret A.S. had mines near Bigadic. The other two producers were Yakal Borasit Ltd. and Kemal A.S. Total capacity of these producers was 40,000 to 50,000 tons per year.

Cement.—Total capacity was 17 million tons per year concentrated in 34 factories in 25 different Provinces. The state-owned Turkiye Cimento Sanayii A.S. operated 15 cement plants with a total annual capacity of 1.5 million tons per year in 1978. Orders were placed for the erection of seven new plants averaging 1,750 tons per day. Two finish cement mills were to be supplied for each plant. The largest private producer was the Sabanci Group, which accounted for 25% of total annual production. Polysius reported the startup of a 3,000-ton-per-day plant at Taslium in 1978. Canakkale Cimento Sanayii T.A.S. of Istanbul increased production capacity to 5,000 tons per day in 1979. Expansions to facilities in both the public and private sectors were to increase cement production capacity to 20 million tons per year by 1980.

Emery.—About 80% of the world's production of emery of fine grain quality was produced in Turkey. Most material was produced and exported in the raw form to France, the United Kingdom, the Netherlands, and the Federal Republic of Germany for use mainly in abrasives. Etibank had a production capacity of 30,000 tons per year from the area of Milas in Western Anatolia. There was only one major producer of emery, apart from Etibank, Lutfullah E. Kitapei Mineral Co. Ltd., which had a production capacity of 70,000 tons per year from several small mines in the vicinity of Mugla.

Fertilizer Materials.—Turkey had an annual production capacity of 3.9 million tons of phosphate fertilizer and 3.6 million tons of nitrogen fertilizers in 1978 with planned expansions to reach 10 million tons total capacity to satisfy domestic requirements. Only about one-third capacity was reached, however, and Turkey remained dependent on fertilizer imports. The primary reason the fertilizer plants did not operate at full capacity was the lack of effective cooperation in the procurement of phosphate rock, ammonia, sulfuric acid, pyrite, and phosphoric acid required to produce fertilizer.

The state-owned Azot Sanayii T.A.S. planned the construction of a fertilizer complex at Mersin, located in southern Turkey. Annual production was to consist of 630,000 tons of sulfuric acid, 215,000 tons of phosphoric acid, 544,000 tons of ammonia, 330,000 tons of urea, and 420,000 tons of diammonium phosphate.

A fertilizer and industrial chemicals complex was completed in 1978 at Karatas near Adana.

Negotiations between Istanbul Gubre Sanayii and Toyo Engineering (Japan) took place in 1978 for the construction of a nitrogen fertilizer complex at Kirikkale in central Anatolia. The International Bank of Reconstruction and Development was to provide most of the financing for the $130 million project. Construction of the plant, to produce 1,000 tons per day of ammonia and 1,750 tons per day of urea, began in 1979.

Etibank had a sulfuric acid plant at Bandirma with annual capacity of 120,000 tons (H_2SO_4 content) and was increasing sulfuric acid capacity at its copper plant at Ergani in 1979. The Black Sea Copper Works was also a large byproduct producer of sulfuric acid, with an annual capacity of 365,000 tons from pyrite concentrates.

Phosphates.—Etibank continued development of the Mazidag phosphate deposits located in southeast Turkey near Mardin. Turkey planned to increase capacity at Mazidag from 250,000 tons per year to 1 million tons per year by 1982. Processing and storage facilities were under construction at Karatas. Reserves at Mazidag were estimated at 410 million tons of phosphate ore assaying 10% to 21% P_2O_5.

Magnesite.—Magnesite was produced at three major mining districts: Eskisehir, Kutahya, and Konya. The state accounted for about 25% of production and was considering the nationalization of private magnesite operations. Total reserves were estimated at 65 million tons with an average content of 46% MgO.

There were four important producers of magnesite in Turkey: Kutahya Manyezit Isletmeleri A.S. (Kumas), Manyezit A.S., Sumerbank, and Continental Madencilik Sanayi ve Ticaret A.S. (Comag). Kumas is the largest dead-burned magnesite producer. Its mines at three deposits had an annual capacity of 250,000 tons. The Kutahya Magnesite Works, a joint venture of Etibank and Kumas, had an annual capacity of 70,000 tons per year of sintered magnesite and was to produce 55,000 tons per year of refractory bricks by 1981. The other state-operated facility, Konya Magnesite Works, was to increase production from 50,000 tons per year to 100,000 tons per year of refractory bricks. Sumerbank was the only major producer outside the Kutahya-Eskisehir region. The rest of the dead-burned production comes from Manyezit A.S. with an annual capacity of 60,000 tons.

Comag manufactured only caustic-calcined magnesia. Two areas were mined with total capacity of 30,000 tons per year. Plants were located at Tavsanli and Kumbet.

Perlite.—Interest in mining known perlite deposits scattered all over the country was gaining ground owing to the rise in world demand. There were two mines at Camaovasi near Izmir with total annual capacity of 180,000 to 200,000 tons.

Etibank had developed an integrated perlite mine together with a processing plant at Camaovasi, Izmir, to manufacture 137,000 tons per year of processed perlite and 50,000 cubic meters per year of expanded perlite. Zihni International Trade and Marketing owns the other mine in the Izmir area with an annual capacity of 50,000 tons. Plans called for setting up a grinding plant with a capacity of 75,000-100,000 tons per year.

Palbalk Ticaret Ltd. produced about 70,000 cubic meters of expanded perlite per year. Izmir Perlite Mining and Industry Ltd., Anadolu Per-Mer Madencilik Sanayi ve Ticaret Ltd. Sti, and Durum Urum each have an annual capacity of less than 10,000 tons.

Pyrophyllite.—Turkey became a commercial producer of pyrophyllite in 1976. Industrie Mineralleri ve Taslari Sanayii Ltd. produced 3,000 tons per year and planned to substantially increase production. Reserves were estimated at 6 million tons.

MINERAL FUELS

Coal.—Absolute dependence on lignite for home heating and thermal power stations caused Government nationalization of all lignite mines. Abundant lignite sources existed, but the air pollution problems caused by high ash and volatile content limit the use of lignite on a large scale. About 70% of Turkey's coal requirements were met by domestic production. Turkey planned a long-term expansion program to increase the mining of hard coal and to triple lignite production for use in thermal powerplants.

Hard coal was mined in the Zonguldak District by Eregli Coal Mines. Annual production was 4.8 million tons and was to increase to 5.8 million tons per year. Reserves were estimated at 1.3 billion tons. Turkiye Komur Isletmeleri (TKI) operated the major mines of Kandili, Kozlu, Uzulmez, and Gelik.

The major part of lignite production came from Tunebilek, Seyitomer, Soma, and Beypazari districts. TKI operated production capacity of 4 million tons. Reserves were estimated at 250 million tons. State-owned Western Lignites Co. mined approximately 2 million tons of lignite annually at Seyitomer. Reserves were estimated at 230 million tons. Both public and private companies operated at Soma. Krolin Madencilik, the largest private lignite company, had an annual capacity of 1.5 million tons. Reserves were estimated at 100 million tons.

Over 3 billion tons of lignite were estimated in the Afsin-Elbistan area. Output was expected to reach 20 million tons per year by 1980. Development of the Elbistan coal open pit began with the stripping of 4,200,000 cubic meters of oveburden. Production was expected to begin in 1981.

Work was continuing without interruption in order to commence operations at the recently nationalized Pekeric lignite deposits in Erzurum's Pasinler District. Deposits contained approximately 7.5 million tons of lignite. Production was to begin by 1980. The Alicevrek lignite fields were also turned over to the Erzurum Eastern Lignite Establishment.

Petroleum.—Domestic production supplied about 20% of the country's petroleum requirements. There were no significant discoveries of oil despite extensive land and offshore seismic exploration by the state-owned Turkiye Petrolleri Anonim Ortakliki (TPAO) and N.V. Turkse Shell (Shell), the largest producers. It was felt that known oil reserves were sufficient only for another 15 years' production and that it was unlikely that new fields would be located, at least onshore. Total reserves were estimated at 350 million barrels.

TPAO initiated a $3 million program to test enhanced recovery methods for Bati Raman oilfield near Batman. Production from Bati Raman was expected to exceed 10,000 barrels per day by 1980. TPAO planned to open 40 new production wells by 1980 which were to increase production from 25,000 barrels per day to about 30,000 to 32,000 barrels per day. Shell was producing about 32,000 barrels per day. The other two producers, Mobil Exploration Mediterreanean Inc. and Ersan Petrol Sanayii, were producing at the 7,000-to-8,000-barrel-per-day level.

Turkey's crude oil consumption rose to 350,000 to 360,000 barrels per day in 1979.

Refining.—Negotiations were in progress for the nationalization of the Anandolu Tasfiyehanesi A.S. (ATAS) refinery at Mersin, which would put all petroleum refinery operations under TPAO. The 90,000-barrel-per-day refinery is a joint venture of Mobil Oil Co. (51%), Royal Dutch Shell (27%), British Petroleum (15%), and Marmara Refining (7%). This action was initiated following 40% capacity operations in 1978 and resulting product shortages owing to the shortage of foreign exchange for imported crude oil.

TPAO's refineries at Batman and Izmir operated at rated capacity. A catalytic cracker was added at the Izmir refinery, which was undergoing expansion to 200,000 barrels per day by 1981. The refinery at Izmir, operated by Istanbul Petrol Refineries A.S., a TPAO subsidiary, was to increase production capacity to 250,000 barrels per day by 1980.

TPAO signed an agreement with Romania for the construction of a 100,000-barrel-per-day refinery at Kirikkale in Central Anatolia to be completed in 1980. Naphtha from the refinery was to supply the 1,000-ton-per-day ammonia and 1,750-ton-per-day urea fertilizer plants at Kirikkale.

Uranium.—Although Turkey did not mine uranium, the 1978 program budgeted $80,000 mining investment by Turkey's atomic energy agency. Extensive ground and airborne surveys continued in the Manisa-Afyon region. A deposit of 2,700 tons of ore was delineated at Koprubasi, Manisa, and a pilot plant was established. Production was to start upon completion of Turkey's first nuclear powerplant, scheduled for 1984. Surveys were also conducted over the Thrace and Beypazari basins near Ankara where uranium potential was suspected.

It was reported by the Woods Hole Oceanographic Institute and the Institute of Palaentology at Hamburg University that the world's largest known uranium deposits were discovered in deep water in the Turkish part of the Black Sea. Approximately 6.7 million tons of uranium oxide were suspected to be contained in the deposits covering 100,000 square miles at depths from 3,500 to 7,000 feet. Deposits were fine grained and nonconsolidated, and while mining was technically possible, it was more costly than land mining.

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[1] Economist, Branch of Foreign Data.

[2] Physical scientist, Branch of Foreign Data.

[3] Where necessary, values have been converted from Turkish Lira (TL) to U.S. dollars at a rate of TL24.04 = US$1.00 for 1978 and TL37.5 = US$1.00 for 1979.

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The Mineral Industry of the U.S.S.R.[1]

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The U.S.S.R., with complete nationalization and low-wage labor, is the world's second largest producer of industrial products. It is the leading world producer of iron ore, manganese ore, platinum-group metals, petroleum, steel, potassium salts, asbestos, and cement. It occupies second place, following the United States, in world output of aluminum, lead, natural gas, coal and phosphate rock; it ranks second, after Canada, in the production of nickel and follows South Africa in gold and chromium ore output. Production targets are determined in principle by the 1976-80 national plan for economic development. The U.S.S.R.'s mineral industry has been a major factor in the country's development. The country has large reserves and resources of many minerals and because of its export position is a significant factor in the mineral economy of the world.

For many years Soviet industrialization was directed towards the expansion of heavy industry, which in turn necessitated the expansion of mineral and metal output. Although successful in achieving production targets, Soviet technology has not developed in parallel with that of the expanding economies in the West.

In 1978, industrial output increased 4.8% (4.5% planned) to a value of 587 billion rubles. National income rose 2.5% (2.4% planned) to 417 billion rubles. Heavy industry (group A) output rose 5% (4.7% planned), and consumer goods (group B) production rose 4% (4.7% planned). Investment rose to 129 billion rubles, or 5% (3.5% planned).

In 1979, industrial production rose only 3.4% (5.7% planned), national income increased by 2% (4.3% planned), and the Soviet Union has confirmed that its economy has suffered its worst year since the Second World War. Heavy industry grew 3.5% (5.8% planned), and consumer goods production rose 3.3% (4.6% planned). Industrial labor productivity grew only 2.4% (4.7% planned).

The U.S.S.R. Ministry of Ferrous Metallurgy failed to fulfill targets for the production of steel, pig iron, finished rolled products, and iron ore. The poor performance of the ferrous metallurgy industries resulted mainly from delays in plant modernization, labor shortages, and transportation problems. The U.S.S.R. has insufficient capacity to produce certain steel products, and it has been forced to rely more on imports after failing to produce the desired quality of pipe and sections for its various industrial projects. Ferrous metallurgy has not solved the problem of improving the quality of products and extending and optimizing quality grades. The balance in the development of ferrous metallurgy works is not being maintained; for instance, at Cherepovets a powerful rolling mill was built before the blast furnace and oxygen-converter shop, and thus metal had to be brought from Zhdanov and other distant places.

Chemical and petrochemical output in a number of key sectors has failed to achieve planned goals for the fourth successive year. In 1979, the chemical and petrochemical industry registered a 3% increase compared with the 1978 level. This was below the 6% increase in 1978 and 7% increase in 1977 and certainly falls behind the 10.5% compound annual growth envisaged in the 1976-80 plan. Fertilizer production fell by 3.6%. The industry is unlikely to achieve the 1980's originally planned target of 143 million tons. Fertilizer deliveries to consumers of 76 million tons in 1979 fell behind the planned target of 85.6 million tons.

The slow development of advanced methods of mining, concentration, roasting, smelting, and metal rolling has resulted in a great deficiency of nonferrous and rare metals. Copper, lead, nickel, cobalt, and tin are mainly extracted by pyrometallurgical routes, and almost all the furnaces are of outdated design. The installation of outdated furnaces in new shop plants continued in 1979.

Because of the use of ordinary refractories in furnace linings, productivity is affected. Their reliability is very low, and idle time is great. The refractory industry does not produce the large bricks necessary for suspended roofs of reverberatory furnaces and the tuyere zones of converters, nor does it produce the more durable heat-resistant brick.

On the whole, the Soviet mineral industry is lagging. Despite the fact the U.S.S.R. is the world's leading producer of steel, pig iron, mineral fertilizers, and cement, the mineral industry has failed to deliver to the economy its requirement of iron, steel, rolled metal, cement, mineral fertilizers, and other products. The shortage of metals and cement is holding back the development of allied industries, especially machine building and construction. This stems from the fact that the performance of the Soviet industry is measured by units of gross weighed output rather than units efficiently consumed in the economy.

Expansion of the mineral industry continues to be achieved mainly through increased labor and capital rather than advancing technology. It is estimated that two to three times more investment and labor in real terms are required in the U.S.S.R. than in the principal countries of the West to achieve a given increase in mineral output.

The U.S.S.R.'s reported mineral commodity consumption per capita approaches that of Western Europe, although there is still a significant difference in the living standards. One reason for the apparent difference is that the growth is measured in terms of energy and minerals produced, not in terms of energy and metals usefully consumed. In addition, fuel and mineral shortages often bring with them substandard commodities which are marketed as standard items.

Mineral Industry Labor.—Practically all sectors of the mineral industry maintained a greater number of production personnel than called for by plan targets. The Soviet economy employed 111 million industrial workers, 51% women. The Soviet ferrous and nonferrous industries employed over 3 million workers,[3] and the coal industry employed 2.2 million.[4] The oil, gas, and petrochemical industries employed 2.6 million, including over 250,000 in the development of oilfields and gasfields.[5] The crude oil extraction industry employed about 740,000 persons.[6] There were about 155,000 graduate mining engineers in the Soviet economy in 1979. Mining engineers are trained at 38 Soviet institutes. The workweek in the U.S.S.R. is 41 hours for standard workers and 36 or 30 hours for underground miners. Soviet statistical agencies do not publish data on the actual earnings of mineral industry workers. The average official monthly earnings of all Soviet workers and employees in 1979 were 164 rubles,[7] compared with 160 rubles in 1978, an increase of 3%. In 1979, the monthly minimum wage was 70 rubles. Wage increases for some 12 million workers and employees in the nonproductive sectors of the Soviet economy went into effect in 1979. Although the increases range up to 30%, they affect primarily the lower paid workers and employees who are on or near the minimum wage scale of 70 rubles a month.

Labor turnover remains a serious problem, particularly in the north and northeast. Turnover of personnel in individual mineral industry operations ranged from 25% to 80% per year. This was caused mainly by the lag in building houses and in providing public and medical services, and by low material incentives. The output quota-bonus principle, once condemned as an exploitation of the worker, has become an important feature of the mining industry. Soviet labor legislation requires that workers achieve a minimum output within a given period. This minimum is the work norm and is established for virtually every phase of employment. Following the significant increase in output quotas, there has been a substantial increase in the proportion of workers not meeting the increased quotas established during the last 4 years.

Government Policies and Programs.—A Decree of the CPSU Central Committee and the U.S.S.R. Council of Ministers "On Improving Planning, Increasing Impact of Management on Production Efficiency and Quality," adopted July 12, 1979, provides priority for the following major economic programs: saving fuel and metal, building the Baykal-Amur Railway, reducing manual labor and comprehensive mechanization of manual and auxiliary operations, the

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program of increasing the production of new consumer goods, and new methods of evaluating production.

Until now the basic evaluation index has been gross production, but according to the new Decree, results are to be evaluated by the index of net production. Soviet planners believe that the net output index will remove the incentive to use the more expensive raw materials and semifinished goods, thus increasing the cost of an enterprise's gross output.

The new system, if it can really be called such, is based on the old idea that enterprises should be given fairly detailed targets and then be required to meet them. Fifteen years ago, the belief that such a system of rigid centralized planning was ineffective prompted the economic reform of 1965. That reform failed, however. Now there has been a definite return to the traditional system of planning.

Much attention is now being paid to economic "integration" and industrial "cooperation" within the Comecon[8] group of countries, and this tends to make East Europe, Mongolia, Cuba, and Vietnam more dependent upon the Soviet mineral industry. The East European countries are uniformly interested in the widening of economic contacts with the Western countries. The 33rd Session of Comecon, held in Moscow in June 1979, adopted special programs for long-term cooperation until 1990 in energy, fuel, raw materials, the agricultural food industry, and machine building.

On the average, for each of the two successive 5-year plan periods during 1981-90, the value of Comecon joint investments made directly by members is to be more than four times the level planned for the 1976-80 period. The largest element will be directed towards the development of the Soviet Union's energy and raw material sectors. The long-term Comecon joint investment projects (Target Programs) planned for the 1981-90 period, involving five major economic sectors, will require 65 to 85 billion transferable rubles. As during the current 5-year plan period, a very large part of the Comecon joint investment will be spent for the development of the Soviet fuel, energy, and raw material sectors.

The Plan for Multilateral Integration Measures for the Comecon (1976-80), includes, among other Soviet projects, the joint construction and financing of the Kiyembay asbestos complex (first stage completed), the development of the Orenburg Gasfield and the gas pipeline from Orenburg to the Soviet western border (completed), the 750-kilovolt transmission line from Vinnitsa to the Hungarian border (completed), and new facilities for iron ore mining, ferroalloys production, and petroleum refining elsewhere in the U.S.S.R. (under construction). Reportedly, the total investment in joint projects involves about 9 billion transferable rubles by participating Comecon countries with provisions for repayment to be made in raw material produced (asbestos, iron ore, ferroalloys, natural gas, petroleum, and electric power).

One of the new forms of economic cooperation is "compensation" or "buy-back" agreements which provide for the creation in the U.S.S.R. of large industrial enterprises with the investment of foreign credits. Because of the limited availability of good-quality mineral industry machinery and equipment, the U.S.S.R. is showing increasing interest in "joint" or "compensation" development ventures and in the exchange of scientific and technical services with foreign countries and Western firms. While the law prohibits any direct foreign capital investment, foreign investors are invited to develop deposits and to construct plants in the U.S.S.R., and repayment is promised in the form of commodities produced. The joint ventures should help the Soviets to introduce new technology.

According to Soviet sources, the value of buy-back agreements and contracts is estimated at several billion rubles for many projects in the chemical, petrochemical, petroleum, gas, and coal industries as well as in ferrous and nonferrous metallurgy. Some of the arrangements with the West have also involved Comecon joint investment projects. This category includes the agreement with Austrian, French, Italian, and West German firms for delivery of large-diameter steel pipes, fittings, equipment, and materials for developing the gasfields and building gas pipelines. Deliveries of natural gas will pay for the credits.

This type of transaction fits well with the Soviet planning system. The foreign trade organizations do not have to worry about the lack of hard currency, and the Soviets do not need to search for markets in order to earn the much-needed hard currencies.

Reportedly, the chemical industries of the Federal Republic of Germany, the United Kingdom, and France are beginning to experience some economic dislocations caused by buy-back deliveries, and fears of more pronounced effects in the near future have stimulated objections by trade unions and chemical plant owners.

Economic cooperation between the U.S.S.R. and the developing countries concentrates mostly on the establishment and expansion of energy and raw material production. Ties between Morocco and the U.S.S.R. received another boost with the signing in July 1979, of a 5-year agreement for development of phosphates and the possible development of oil shale. Reportedly, Nigeria and the U.S.S.R. have signed an agreement for the construction of an integrated steelworks at Ajaokute worth some £960 million, and Guyana may purchase machinery and equipment made in the U.S.S.R. using Soviet credits. The U.S.S.R. has not assisted directly in the development of mineral deposits in developing countries.

Mineral Industry Technology.—The mechanization of labor-intensive manual work in the Soviet economy is proceeding very slowly. In the past several years, the number of manual workers has increased substantially, and, in many enterprises, their proportion has become significant. According to Problems of Economics,[9] there were about 45 million manual workers in the Soviet economy in 1974. The work performed manually without machines is indicated by the following figures: 55.7% at coal mines, 60% at longwalls, 57% in development, and 100% on repair of workings. At nonferrous mines and plants in Kazakhstan, manual labor comprises 54% and planned production goals are met by increasing manual labor levels. More than 50% of the heavy and labor-intensive operations at ferrous-metallurgical enterprises have to be done manually. Over 67% of the workers in blast furnace production perform manual operations. The situation is somewhat better in steel-smelting production, where 55.8% of the workers perform manual labor.[10]

The equipment currently used in mining is not large by Western standards. Excavators with scoop capacities of 4 to 8 cubic meters are needed in combination with trucks of 110- to 180-ton capacity. The use of one 500-horsepower bulldozer to replace four of the T-100s now in use makes it possible to release 12 persons at once.[11] The main trouble, however, is that the machine builders have been failing to manufacture new equipment for many years. Over the past 10 years, only one-third of the equipment ordered for nonferrous metallurgy has been supplied.[12] Equipment used in Soviet mineral industry is standardized and of types made earlier in Western Europe and the United States. The production of mining equipment has grown substantially, but the technical standards and the quality are poor.

At a number of concentrating plants, the recovery of metals is low. Still unsolved is the problem of gold and zinc recovery from the copper pyrite ores in the Urals. At many polymetallic ore deposits, the constituent elements, especially rare metals, are being inadequately recovered. A major reason for the poor recovery is ore dilution. Tonnage extracted rather than grade or quality is the criterion, and this leads to the extraction of large tonnages regardless of the grade. Research and planning agencies appear not to cooperate adequately wtih the industries. New ideas are abundant, but their testing and application are delayed by the absence of a research testing base, insufficient coordination, and duplication of effort on the part of the research institutes.

The Soviet economy is going through one of its worst periods since the end of World War II, and a rapid increase in productivity is needed. The planned average annual increase of productivity for the period 1976-80 was 6.1%, but the actual official increases have been 3.3% in 1976, 4.0% in 1977, 3.6% in 1978, and only 2.4% in 1979. The 1980 plan calls for an increase of 3.8%, much too high a figure as there can be little hope of increased labor productivity. Moreover, the yearly average labor productivity growth has been decreasing.

Transfer of Technology.—Scientific and technological cooperation with developed Western countries holds an important place in the system of foreign economic relations of the U.S.S.R. Recently, these programs have become longer term and larger in scale. Western technology is a key factor that can favorably influence Soviet economic performance. The transfer of technology and licensed manufacture of products is largely one-sided, with the U.S.S.R. usually on the receiving end.

The rate of growth in Soviet trade with the West will slow substantially in the next few years. In the 1973-78 period, Western companies completed more than 60 compensation agreements. In the next 5-year period (1981-85), Soviet planners expect that only 15 new compensation projects will be completed. According to Soviet sources, projects for the chemical industry will receive less attention in the future. Demand for Western technology by the U.S.S.R. is unlikely to diminish, and the gap between Eastern and Western technology will continue.

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In the past decade, the Soviet Union has made a major effort to catch up with Western technology. Imports of Western technology and equipment have not given a sharp boost to Soviet productivity, and inefficient use of material resources, especially metals and energy, continued in 1978-79.

A Soviet-Japanese conference on the development of natural resources in Siberia ended in Moscow on September 27, 1979. It examined several projects already underway, including the production of coking coal in Southern Yakutia, exploration of natural gas fields in Yakutia, and exploration for oil and gas off Sakhalin. It is expected that Japan will extend an additional yen loan, equivalent to $40 million, for the U.S.S.R. to import a coal-dressing plant from Japan for Southern Yakutia. Both sides confirmed their interest and promised to continue discussion on the building of an integrated steelworks on the Soviet Far East coast, the construction of a copper smelter in Udokan, and asbestos development in Molodezhnaya.

The Soviet Union and France have signed agreements on economic, industrial, and technical cooperation for 1980-90 and on economic cooperation for 1980-85. However, there are growing indicators that Italy is postponing negotiations with the Soviet Union for a new $1,000 million 3-year Italian credit.

The Federal Republic of Germany was the largest Western exporter of equipment and machinery to the U.S.S.R. in 1978-79. Its involvement includes deliveries of trucks for the construction of the Baykal-Amur Main Railway, the Kama automobile works, the Oskol metallurgical complex, and a number of large chemical complexes. Daimler Benz has received Soviet orders worth DM15 million for 150- to 320-horsepower trucks. Krupp of Essen is to build an electrosmelting plant at the Soviet iron and steel complex in Staryy Oskol near Kursk, which is to start operating in 1982. Under the contract, signed in Moscow in March 1979, four electric furnaces are to be installed, mainly for the production of high-grade steel (1.45 million tons annually). The contract is worth about DM350 million to Krupp, and the total cost of the electric steel plant is estimated at DM600 million. The project is largely being undertaken by Krupp and four other German companies. Within the framework of an agreement worth DM50 million, the Schiess AG group will supply a mill capable of working pieces weighing up to 800 tons. A contract was signed in April between Metallurgimport of the U.S.S.R. and Creusot-Loire of France for the delivery of equipment for the manufacture of 170,000 tons of seamless pressed pipes a year. Under a contract worth F1,000 million, France and the Federal Republic of Germany are to supply the Soviet Union with equipment.

Over 90% of the natural gas supplied by the U.S.S.R. to Western Europe is exported under compensation agreements signed between 1968 and 1974. Discussions with German energy companies on the construction of a 4,300-kilometer natural gas pipeline from West Siberia to Europe at a cost of $11,600 million continued in 1979. It could be in operation by 1986 with a 40,000- to 50,000-million-cubic-meter-per-year capacity.

The Soviet Union depends on Western, in particular U.S., oil and gas technology. Reportedly, the U.S. Department of Commerce has approved 75 applications for the export of petroleum equipment to the U.S.S.R. The value of equipment and machinery to be delivered is understood to be about $280 million. Dresser Industries has sold a $144 million plant to manufacture oil drilling bits. The Soviet Mashinoimport has awarded a $15 million contract to International Enterprise Inc. of Oklahoma City for 10 combination drilling rigs. The Soviet Union has placed F140 million worth of contracts with Dutch firms for chemical products used to maximize Soviet oil and natural gas production.

Reportedly, Japan, the United States, and Soviet Union have agreed on a plan to construct the Yakutia-Olga (near Nakhodka, Soviet Far East) gas pipeline to transport natural gas to Japan and the United States. It is designed to supply the United States and Japan with 1 billion cubic meters of natural gas each, with the gas liquefied at Olga. Both countries are expected to supply equal amounts of bank loans for the procurement of steel pipes, excavators, liquefaction plant, and other necessary equipment. The estimated cost of the project is $4 billion. At the Nerunga coal deposit in Southern Yakutia, U.S. and Japanese heavy earthmoving equipment is being used. Komatsu Ltd. has supplied 30 HD-1200 dump trucks (120-ton capacity each), worth about $22 million to be used in cold areas of the Soviet Union.

Davy International has signed a £50 million contract with Tekhmashimport for the engineering and supply of a 75,000-ton-per-year alpha-olefins plant to be built at Nizhnekamsk in the Tatar A.S.S.R.

Monsanto has agreed with Société pour l'Equipment des Industries Chimiques of France to supply technology for production of orthonitrophenol in Navoi in the south-central region of the U.S.S.R. In November 1979, the Brussels-based chemical subsidiary of Exxon (Esso Chem Impex) signed two technical agreements with the Soviet Ministry of Oil Refining and Petrochemicals and the Ministry of the Oil Industry, respectively. These call for technical cooperation in developing the use of Esso Chem Impex chemicals in the Soviet Industry.

The Swedish company Asea has received an order worth SKr150 million for the construction of a special type of plant for the Staryy Oskol steelworks near Kursk. Delivery of equipment is to be completed by 1982. Large high-pressure slurry pumps made by Holtius B.V. of Holland will be delivered to the U.S.S.R. The 1,600-kilowatt pumps, which will be used on an iron ore concentrate pipeline, have a capacity of 520 cubic meters per hour. The Auran enterprise of Finland was to export 38 mine loaders, valued at Fmk18.6 million, in 1980 and a further 16 in 1981.

The largest compensation deal so far arranged was with Occidental Petroleum in 1973-74. The agreement provided for the delivery of equipment for nitrogen fertilizer plants and for building pipelines to transport liquid ammonia to the coast. In return, products from these plants, for a value of $20 billion, are to be shipped to the United States over a period of 20 years. The U.S. equipment is being installed in the Soviet Union's largest chemical complexes in Togliatti, Novgorod, Dneprodzerzhinsk, and elsewhere. Some 400,000 tons of liquid ammonia were exported to the United States in 1978. It was planned to export about 1 million tons in 1979. Reportedly, on December 14, 1979, Occidental signed two new contracts with Soviet foreign trade organizations. One calls for the delivery of 450,000 tons of Soviet ammonia in 1980, in addition to the 250,000 tons already contracted for that year, while the second involves the purchase of 1 million tons each of potash and urea from the U.S.S.R.

President Carter has imposed an import quota of 1 million tons of ammonia for 1980. Imports were previously scheduled to rise to 1.2 to 1.4 million tons in 1980, having reached 0.9 million tons at a value of $100 million in 1979. U.S. sales of superphosphoric acid to the U.S.S.R. totaled $97 million in 1979 and were expected to reach $400 million in 1980. President Carter has ordered an embargo on shipments of phosphates to the U.S.S.R. for an indefinite period.

In 1979, France supplied the Stirka production association in Rozdol, Lvov Oblast' with plant to produce nitro-ammophosphates. U.S. drilling rigs were delivered to the Baykal-Amur Railway for driving the Severomayskiy tunnel.

The Soviet Union is to assist in the construction of a 3-million-ton steel plant at Vishakapatnam in India at a cost of 1.4 billion. This is the third Soviet-aided steel plant in India. The U.S.S.R. and India are to cooperate in developing processes for selective flotation of copper and lead, in investigating low-grade ores, on coal development in India, and in the application of computer modeling technology.

The U.S.S.R. has agreed to deliver the necesary equipment to complete the construction of the second stage of the Esfahan steel complex in Iran. This will increase the plant's annual capacity to 1.9 million tons of steel. Reportedly, Nigeria and the U.S.S.R.'s Tyazhpromeksport have signed a contract for the construction of a 1.3-million-tons-per-year steelworks at Ajaokuta worth some £900 million. The Soviet Union is to assist in the construction of the La Maste steelworks in Algeria; the financing will be provided within the terms of the 1976 Soviet-Algerian credit agreement.

Turkey and the U.S.S.R. are reported to have agreed in principle for the Soviets to construct and equip a nuclear powerplant in Turkey. The Soviet Union is planning to construct one 120,000-barrel-per-day refinery in Vietnam. The U.S.S.R. is engaged in a joint project with a Finnish steel company to sell small steelworks to developing countries. The Soviet Union, together with some Finnish firms, has submitted a tender to build four thermal powerplants in Iraq.

The Plan for 1980.—The state plan for 1980 was ratified by the Supreme Soviet on November 30, 1979. The original target for 1980, set as part of the 1976-80 plan, had been reduced. A significant cutback in industrial growth targets, in a bleak economic projection, confirmed that the economy will fall far short of meeting the targets of the current 5-year plan. Overall industrial output in 1980 will grow by only 4.5%, which is well below the plan target of 5.7% for 1979 and the average annual rate of 6.5% projected in the 10th 5-year plan. Heavy industry, or category A production, was to grow by 4.5%, compared with 5.8% projected in 1979. Light industry, category B, production was also to grow by 4.5% compared with 5.4% for 1979. Achievement of these targets would mean a total rise in industrial pro-

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duction over the 1976-80 period of 25.7%, far short of the original target of 36%.

The 1980 targets for all fuels except natural gas were scaled down from those set in 1976. Oil output in West Siberia, the main producing region, is to rise from 5 million barrels per day in 1979 to 7 million by the end of 1980. The increase in 1980 was to be achieved by increased drilling of new wells in West Siberia. To accomplish this, 23% more drilling equipment would have to be produced in 1980. It was planned to put into operation the 1,000-kilometer section of the Surgut-Polotsk oil pipeline in 1980. It was also planned to commission new facilities at the Baku XXII Congress CPSU, Kirishinsk (Leningrad Oblast'), and Kuybyshev primary refineries.

The brightest spot in the energy picture is natural gas. The 505-kilometer section of the second string of the Urengoy-Chelyabinsk pipeline and the 608 kilometer section of the Petrovsk-Yelets pipeline were to be commissioned in 1980. For lignite, the main increase was to be from open pit operations in Kazakhstan and Siberia. Increased coal production was to be from the Kuznetsk, Karaganda, Ekibastuz, and Kansk-Achinsk Basins.

For steel it was planned to commission additional facilities at the Mikhaylovsk (Kursk region), Novokrivorozhsk, and Central (Krivoy Rog) iron ore mining and concentration complexes.

Soviet priorities for the 1980's will continue to be the vital oil, gas, and machine-building industries. Oil and gas production are so important (as energy and hard currency sources) that adjustments will be made elsewhere to ensure fulfillment of the planned targets. There will be continued exports of petroleum and natural gas and imports of steel pipe, pipelining, and petroleum and natural gas extraction equipment.

Table 1 compares the revised goals for 1980 with those originally set.

Table 1.—U.S.S.R.: Soviet industrial planned production, 1980

(Million tons)

Commodity	Originally planned (low range)	Revised goals
Iron ore, usable	276	NA
Pig iron	NA	115
Steel, raw	169	157
Coal, raw (bituminous, anthracite, and lignite)	800	745
Crude oil (including condensate)	620	606
Natural gas, billion cubic meters	400	435
Mineral fertilizers (Soviet standard)	143	115
Power, electric (billion kilowatt hours)	1,340	1,295
Cement	143	NA

NA Not available.

Exploration.—Over 5,000 deposits of various minerals were being exploited in 1978-79. Extensive prospecting and exploration for practically all commodities was carried out on a large scale. There were over 500,000 employees in the geological and prospecting organizations in 1979, including over 120,000 graduate specialists with university and technical education. The Ministry of Geology had 36 research institutes and 2 design establishments with a total staff of over 40,000 persons. A total of over 4 billion rubles was allocated for geological exploration in 1979. Over 2 billion rubles was for oil and gas and some 200 million rubles for coal. Every year geologists of Ministry of Geology alone complete more than 20 million meters of core well drilling, over 3 million meters of petroleum and gas wells, and about 300,000 meters of various underground mining excavations. The geologists have at their disposal more than 10,000 drilling rigs. In the 20-year period, the total expenditure on prospecting increased four times.[15]

The main purpose of recent Soviet mineral exploration has been to improve the regional distribution of resources for the production of major metals, all fuels, and many nonmetallic minerals. However, during the past 15 years no increment in tin reserves has been achieved even in the Soviet Far East. Poor results were also reported in the growth of reserves of bauxite, lead, zinc, mercury, tungsten, molybdenum, antimony, and nickel (Kola Peninsula).

In recent years, the effectiveness of prospecting and exploration has been reduced resulting in the reduction of the number of deposits transferred for mining. Effectiveness has been especially low at Rudnyy Altay, Dzhungariya, Karatau, and Balkhash. The raw material base is especially poor at the Achisay, Balkhash, Tekeli, Belogorsk, and Kargayly polymetallic complexes, and all gold mining enterprises of Kazakhstan.[14]

There are shortages of bauxite, copper (Urals), nickel (Kola Peninsula), mercury (Ukraine), and lead (Rudnyy Altay and Kazakhstan). While there have been problems in improving the distribution of reserves, production has been increased from existing deposits. Good results were obtained in increasing the quantity and quality (by 50%) of copper-nickel reserves in the Norilsk area, where over 20 teams of geologists were employed in 1979.

Over 2,500 geological and geophysical teams are permanently employed in oil and gas exploration, and about 2,200 exploration wells are completed each year, using some 2,500 drilling rigs. In 1979, the target for oil and gas exploratory drilling by the Ministry of Geology was not met. The speed of drilling remained essentially at the 1976 level (387 meters per rig-month). In 1979, Western Siberia continued to be the main target for Soviet oil and gas exploration, but the speed of drilling was low. The main causes of low performance of drilling operations in West Siberia are the complex transport system for delivery of the basic materials, pipes, and tools, organizational deficiencies, and the severe climatic conditions, which influence the duration of all forms of operations.[15]

Soviet geologists are not well equipped with geophysical instrumentaton, particularly with automated data acquisition and processing equipment. The main method of contouring deposits remains the mechanical method—drilling wells and drifting mine workings.[16] Expenditure on geophysical surveying of oil and gas accounted for 25% of the total exploration cost for these commodities. The total drilling of exploratory and development wells in the oil and gas industry by all ministries amounted to some 15 million meters in 1979. The U.S.S.R. is purchasing large quantities of oil equipment from Western suppliers as exploration of its "vast" oil and gas reserves continues. Offshore prospecting needs specialized geological and geophysical ships and floating drilling rigs, but production of these is proceeding slowly. The first Soviet-made floating rig, *Baku*, is being used for exploratory drilling at great depth in the Caspian Sea. Three wells have been drilled since it has been in operation. Three floating semisubmersible drilling rigs (*Samur*, *Araks*, and *Mamedali Aliyev*), built by Rauma-Repola of Finland, were delivered to Baku in November 1979.

The 1979 plan called for the completion of detailed exploration of the Podol'skoye copper deposit in the Urals, and the Karabinskoye tungsten and Shalkiya lead-zinc deposits in Kazakhstan. Great attention was attached to the completion of exploration of the following iron ore deposits: Severogoro-Blagodatskoye in the Urals, Belanovskoye in Kremenchug region of the Ukraine, and Aleshinskoye in Kazakhstan. Completion of surveying of the Udokan (East Siberia) and Aktogaysk (Kazakhstan) copper deposits and the Kholodnenskoye lead and zinc deposit in East Siberia was planned for 1980. There are almost 25,000 prospectors at work in the area of the Baykal-Amur Railway. It was planned in 1979 to increase the value of prospecting work by 12.5% and to achieve a 20.2% increase in the capital investment in oil and gas drilling.

Prospecting was intensified on copper in the Urals, at the Udokan deposit in Chita Oblast', and in Central and Southern Kazakhstan; prospecting on lead and zinc was conducted in the Rudnyy Altay region on areas adjacent to the Leninogorsk and Zyryanovsk complexes and at the Uchkulachsk deposit in Uzbek S.S.R. Tin prospecting was increased in the Khabarovsk Kray, in the Yakut A.S.S.R., in the Badzhal region of the Khabarovsk Kray, in the Pamirs, and in other promising regions. Prospecting was also undertaken on the northern side of the Talnakh ore deposit at Norilsk. Reportedly, at Gomel' Oblast' near Zhitkovitsy in Belorussia, deposits of lignite have been discovered. The reserves will be mined by surface methods and used in thermal powerplants in Belorussia.

A highly promising oilfield has been discovered on the continental shelf off the northeastern coast of Sakhalin at a depth of 3,400 meters below the bed of the Okhotsk Sea. Oil and natural gas exploration has been going on through the joint efforts of Japan and the Soviet Union in this area. The Soviet Union has asked Japan to provide undersea tunnel drilling technology so that tapping of crude oil may continue even when the sea is frozen over. Several wildcat wells were drilled in 1979. Under the 1975 Japan-Soviet agreement, Japan will receive half of the oil produced from the Sakhalin shelf. Agreement between the U.S.S.R. and Japanese firms has been reached on extend-

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ing joint exploration of oil and natural gas off Sakhalin by 2 years to the end of 1982. The new agreement calls for the Japanese side to provide additional funds of $70 million.

Exploration for oil and natural gas in the Anadyr area (Soviet Far East) is expected to increase sharply during the 1981-85 plan period. Also, according to an agreement, the U.S.S.R. will help Turkey in oil exploration and drilling.

Mineral Reserves.—According to the Soviet classification, the reserves of all mineral raw materials, including gas, oil, and coal, are classified under two correlated systems, as follows:

a. For the purpose of the managed mineral economies of the U.S.S.R., the reserves are divided into two groups, "economic" and "uneconomic." The balance sheet of mineral reserves suitable for exploitation includes only the first of these groups.

b. Depending on reliability of the estimates, the reserves are classified in four categories, A,B,C_1, and C_2 (D_1 and D_2, the still lower reliabilities, are permitted for oil and gas).

The appropriate specifications for each one of the four categories are as follows:

A—The reserves in place are known in detail. The ore body (field) boundaries are outlined by preliminary mining or by exploratory boreholes (wells); the depositional environment, the proportions of different industrial grade of the ore (oil or gas), and the hydrogeologic conditions of the exploitations are ascertained; quality and technological properties of the ore (oil or gas) are ascertained in detail, assuring the reliability of the projected beneficiation (processing) and production operations.

B—The reserves in place are explored. The ore bodies (fields) are outlined by mining or by exploratory boreholes (wells); the depositional environment is known; types and industrial grades of the ore (oil or gas) are ascertained, but without details of their distribution; quality and technological properties of the ore (oil or gas) are known sufficiently well to assure the correct choice of the system for its benefication (processing); general conditions of the exploitation and the hydrogeologic environment, as a whole, are known in a fair detail.

C_1—The reserves in place are estimated by a sparse grid of exploratory boreholes (wells) or mining. This category includes also the reserves adjoining the boundaries of the A and B categories of the ore (oil and gas) and the reserves of the very difficult deposits in which the distribution of the mineral values cannot be ascertained even by a dense exploratory grid; quality, types, industrial grades, and technology of the beneficiation (processing) are ascertained tentatively, by means of analyses and of laboratory tests and by analogy with known deposits (fields) of the same type; general conditions of the exploration and a general hydrogeological environment of the deposit (field) are known tentatively.

C_2—The reserves in place adjoining the explored reserves of A plus B plus C_1 categories and reserves indicated by geologic and geophysical evidence confirmed by boreholes (wells) and mining.

Planning and construction of mining enterprises and the appropriate capital investment are authorized on the basis of economic reserves in place, certified as the sum of the $A+B+C_1$ categories of reserves, in the prescribed ratios. The reserves in place of the $A+B+C_1$ categories are called "explored reserves." Reserves in the C_2 categories are also taken into account in project planning for mining enterprises, to provide a general perspective of the development, but they do not constitute a justification for project planning.

It is planned to increase explored reserves in place during the 1978-80 3-year period by the following quantities: more than 1,000 million tons of iron ore, 25 million tons of manganese ore, more than 4 billion cubic meters of natural gas, 11 billion tons of coal and lignite, 106 million tons of phosphorus pentoxide, 75% of the 5-year target for oil, 68% for copper, 90% for zinc, 57% for tin, and 100% for tungsten, mercury, and other nonferrous metals.[17]

The lag in the ore base is due to the decrease in the volume of survey and exploration work in the seventh (1961-65) and eighth (1966-70) 5-year plans.[18] According to Socialist Industry,[19] the 1979-80 target for exploration of additional reserves of natural gas, copper, zinc, iron ore, and apatite has been met.

A summary of reported Soviet reserves in place in categories $A+B+C_1$ is given in table 2.

Table 2.—U.S.S.R.: Reported Soviet mineral reserves in place in the $A+B+C_1$ categories

(Thousand metric tons unless otherwise noted)

Commodity	$A+B+C_1$
METALS	
Iron ore, 38% iron	60,200,000
Manganese ore, 23% to 26% Mn	250,000
NONMETALS	
Cement	27,720,000
Phosphate rock:	
Apatite, 16% P_2O_5	2,750,000
Sedimentary rock, 13% P_2O_5	2,700,000
Potash, K_2O content	3,800,000
MINERAL FUELS	
Coal: Bituminous and anthracite	230,000,000
Lignite and brown coal	190,000,000
Gas, natural (million cubic meters)	29,000,000
Peat	39,000,000
Oil shale	163,200,000
Petroleum	12,900,000

Construction.—The U.S.S.R. continues to experience difficulties completing mineral industry projects on schedule because of shortages of material, equipment, and labor, and organizational problems. Construction of new projects has remained slow and expensive with the work taking two to three times as long as specified by the State Construction Committee. The 10- to 15-year period required to develop a mine with a capacity of 1 to 2 million tons per year contributed to disparities between the capacities of mines, mills, and metallurgical plants. According to the plan, the renovation time of coal mines with an annual capacity of up to 3 million tons of raw coal is 5 to 9 years. In fact, it takes almost three times as long. For example, the renovation of the Taybinskaya mine in the Kuznetsk Basin should have been completed in 1975, producing 2.4 million tons of raw coal per year. However, the completion of renovation has been postponed to 1981. By this time, the lower seam of coal at this mine will be mined out completely. Thereby, attainment of the planned capacity of renovated mine is ruled out.[30]

The number of uncompleted projects in the construction industry has risen considerably in the last 10 years. In 1965, only 1.7% of the total planned construction projects were not completed, but in 1975 the figure had risen to 40.8%. The total volume of unfinished construction at the beginning of 1979 reached 85% of the annual level of capital investment instead of the 65% average according to established standards. An All-Union U.S.S.R. Ministry of Construction for the Soviet Far East and the Baykal Area was established in November 1979. Several large industrial complexes mining coal and ore, smelting metal, and processing timber are to be located there.

Additional new and renovated production facilities are given in table 3.

Table 3.—U.S.S.R.—Capacity of new and renovated production facilities

(Million ton unless otherwise noted)

Commodity	1976	1977	1978		1979	
			Planned	Completed	Planned	Completed
Iron ore, crude	45.0	14.1	38.4	19.8	NA	NA
Coal and lignite, raw	12.6	17.4	26.6	26.0	30.0	19.3
Pig iron	2.25	0.6	2.4	2.2	NA	NA
Steel, raw	1.2	6.0	3.6	2.9	NA	NA
Mineral fertilizer (Soviet standard)	7.3	4.0	17.0	3.0	NA	15.8
Cement	1.85	4.2	NA	4.1	21.0	NA
Power plant, million kilowatts	11.9	10.0	11.9	8.8	12.3	10.9

NA Not available.

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PRODUCTION

A Soviet decree dated April 28, 1956, classifies as state secrets all data on production capacity, information on reserves, and production plans of nonferrous, precious, and rare metal enterprises and data on fulfillment of these plans. Since Soviet mineral statistics are not published in most cases, much of the data in the production tables is estimated. The country also no longer publishes trade information on many mineral commodities.

Reportedly, 70 elements were recovered in the U.S.S.R. In 1979, one-third of the total crude steel and 20% of nonferrous metals were produced from scrap. The maximum depth of underground coal production reached 1,150 meters in 1979, while the average depth was 430 meters. Many new plants and mines, which were put into operation in the 1971-75 period, produced at only 50% to 60% of their design capacity.[21] During the 1977-80 period, the Asian part of the country (east of the Urals) was to provide an increase of 100% of oil, natural gas, and aluminum, over 90% of raw coal and lignite, and about 80% of copper.

In 1979, the Russian Soviet Federated Socialist Republic (R.S.F.S.R.) continued to rank first among the 15 Soviet Republics in mineral production and produced about 80% of the gold and silver, practically 100% of the platinum-group metals, 90% of the petroleum, over 50% of the natural gas, more than half the coal and steel, and about two-thirds of the electric power. The Ukraine occupied first place in output of coking coal, manganese, and iron ore, and second place in natural gas. This Republic continued to provide about one-third of the total Soviet coal output, over 50% of iron ore, about 50% of pig iron, 39% of steel and rolled metal, and nearly 50% of metallurgical and electric engineering products. The Republic also produces a considerable share of the country's output of titanium, mercury, sulfur, and graphite. Kazakhstan occupied third place in Soviet mineral production and was leader both in reserves and in production of lead, zinc, copper, chromium, and cadmium. There was also considerable production of alumina, titanium, and magnesium.

Although about 400 different minerals are mined and processed in the U.S.S.R., insufficient attention is paid to the comprehensive use of mineral resources. At the Zyryan lead and zinc complex, for example, only 8 out of 16 main components of the ore are extracted; the remainder go to waste. Generally, only the main metals in a given ore type are extracted, and most of the byproducts (zinc, cobalt, silver, barium, etc.) are discarded. Losses of byproducts amount to more than half of the total value of the ores. Losses of associated gas accounts for 20,000 million cubic meters per year, and loss of sulfur from petroleum is 10,000 tons per year.[22] Most of the beneficiation plants at the Kazakh nonferrous metals industry process polymetallic ores, containing pyrite, but only one recovers a pyrite concentrate. The others lose some 1.6 million tons in tailings annually. They contain some 775,000 tons of sulfur, 670,000 tons of iron, about 4,400 tons of lead, over 13,500 tons of zinc, 6,000 tons of copper, and much gold and silver.[23]

The chemical, ferrous, and nonferrous metals industries did not fulfill their 4-year production plans. There were production shortfalls for zinc, sulfuric acid, and copper concentrates.[24] The Krivorozhstal' metallurgical complex in the Ukraine, one of the largest enterprises in the ferrous industry, has had difficulties for a long time, and the performance of the Zhdanov Il'ich metallurgical works is poor.

The coal industry operates under great strain. Many mines, especially at the Donetsk Basin, have not met planned targets. There were shortages of supports and coal-cutting machinery. The railway has failed to supply enough cars for shipping coal.[25]

Many projects have operated over a long period with lower capacities than originally planned. For example, in January 1979, only 6 of Kazakhstan's 23 nonferrous industry complexes attained designed capacity. Inadequate use is being made of capacity for ore mining at the Karagayly and Vostochnyy Kazakhstan copper and chemical complexes, for mining and processing ore and producing blister copper and refined copper at the Dzhezkazgan complex, for the output of lead and sulfuric acid at the Ust'-Kamenogorsk lead and zinc complex, and for producing alumina at the Pavlodar aluminum plant.[26]

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The demand for metallurgical raw materials is not being satisfied. As a result, the production of pig iron, steel, and rolled metal is impeded. The Dnepr, Kachkanar, Lebedinskiy, Mikhalylovskiy and other iron ore complexes did not meet their production quotas in 1979.[27] Many Soviet rolling mills are kept idle because of a steel shortage.[28] The problem of delivering ferrous scrap to metallurgical plants has not been solved. Each year more than 100 million rubles is spent for this purpose. Crosshauls of metal scrap continued in 1979. Most machine-building and metallurgical plants deliver completely unprocessed scrap, often representing a mixture of ferrous and nonferrous metals, owing to lack of the needed equipment.[29] Soviet price of nonferrous metals scrap in rubles per ton was as follows:[30] Copper, 500; brass, 450; bronze, 600; tin, 5,000; nickel, 2,000; lead, 300; aluminum, 350; and zinc, 150. The average production cost of coke was 41.76 rubles per ton in 1977.

Long-term selective mining of the richer and more easily beneficiated ores at a number of the mines in the Maritime region has resulted in shortages of raw materials at a number of operations. The remaining deposits are now relatively poor-grade ores. Under these conditions, the profitability continually decreases, and a number of operations are operating at a loss.[31]

The quality of Soviet metal is low. The U.S.S.R. expends 50% more metal than is used in the United States per unit of product. Every year, large sums are appropriated for new construction to increase the production of metal, but the same effect could be achieved at a lower cost by improving metal quality. Of 3.2 million tons per year of rail production, only one-third undergoes special thermal treatment. The system of planning which is oriented towards quantitative indices, is the chief obstacle to the introduction of new materials, solutions, and design.[32] Drilling bits, drilling pipes, and drilling rigs produced by the industry are of poor quality.[33]

Over the past 12 years, the average quality of Kizel and Karaganda coals has fallen by 600 kilocalories per kilogram (Kcal/kg), that of Kuznetsk coals by 900 Kcal/kg, and that of Donetsk coals by 1,200 Kcal/kg to 4,060 Kcal/kg in 1979. As a result, additional deliveries of 36 million tons of coal have been required by thermal powerplants, and transportaton has required about 600,000 railroad cars.[34]

About 100 million tons of coal and lignite a year are railed from Siberia to beyond the Urals. The volume of shipments is increasing. The transportation problem will, therefore, become still more acute, and yet the Moscow electric powerplants are receiving coal and lignite containing more than 40% foreign matter. These plants were designed to operate with standard coal and lignite, but not with the 50% ash content now being received. Equipment is wearing out quickly, causing the discrepancy between the planned and actual generation of electricity. Corrosion is a further problem in Soviet industry and, for example, causes 60% of the freight trucks to go into premature retirement.

Poor management of the Soviet metal economy results in large losses of usable equipment, spare parts, pipe, and other capital stock being deliberately expended as scrap in order to meet high plan targets for industrial scrap delivery, and in corrosion and deformation of excess stocks and supplies due to inadequate storage and handling.[35] Although 50 million tons of ferrous scrap metal was procured in 1979, it was insufficient to meet the collection plan, which is currently unfulfilled and whose implementation is labor intensive. The responsible recycling agency, Soyuzvtorchermet, incurs many losses and problems. The greatest losses are in the widely scattered rural areas. Another problem is the poor sorting of industrial scrap into metallic and nonmetallic and ferrous and nonferrous components.[36]

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Table 4.—U.S.S.R.: Estimated[1] production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978^{p}	1979^{p}
METALS				
Aluminum:				
Ore and concentrate:				
Bauxite, 26%-57% alumina	4,500	4,600	4,600	4,600
Nepheline concentrate, 25%-30% alumina	^{r}2,400	^{r}2,500	2,500	2,500
Alunite ore, 16%-18% alumina	600	600	600	600
Alumina	2,500	2,600	2,600	2,600
Metal, smelter:				
Primary	1,600	1,640	1,670	1,720
Secondary	150	150	150	150
Antimony, mine output, recoverable metal content tons	7,700	7,900	7,900	8,200
Arsenic, white (As_2O_3) do	7,400	7,500	7,600	7,700
Beryllium: Beryl, cobbed, 10%-20% BeO do	1,650	1,700	1,750	1,800
Bismuth, mine output, recoverable metal content do	60	65	70	72
Cadmium metal, smelter do	2,700	2,750	2,800	2,850
Chromium: Chromite ore, 30%-56% Cr_2O_3	2,120	2,180	2,300	2,400
Cobalt:				
Mine output, recoverable metal content tons	1,800	1,900	1,950	2,000
Metal, smelter do	1,800	1,900	1,950	2,000
Copper:				
Ore:				
Gross weight, 0.5%-2% Cu	^{r}124,000	^{r}124,450	125,000	125,000
Metal content, recoverable	800	830	865	885
Metal:				
Blister:				
Primary	^{r}840	^{r}850	865	885
Secondary	^{r}80	^{r}85	90	95
Refined:				
Primary	760	790	810	830
Secondary	160	160	170	170
Gold, mine output, metal content thousand troy ounces	7,700	7,850	8,000	8,160
Iron and steel:				
Iron ore, 55%-63% Fe[2]	^{r}239,110	^{r}239,715	244,231	242,000
Agglomerated products:[2]				
Sinter	158,251	158,195	159,564	159,000
Pellets	31,398	36,170	45,005	47,000
Metal:				
Pig iron and blast-furnace ferroalloys:				
Pig iron for steelmaking	96,033	97,841	100,875	100,000
Foundry pig iron	8,371	8,552	8,817	9,000
Spiegeleisen	102	100	100	100
Ferromanganese	856	850	880	870
Other blast-furnace ferroalloys	28	25	30	30
Total[2]	105,384	107,368	110,702	110,000
Electric-furnace ferroalloys	1,150	1,167	1,207	1,257
Crude steel:				
Ingots	^{r}135,704	^{r}137,440	141,273	139,000
Steel for castings	9,121	9,238	10,163	10,000
Total[2]	^{r}144,825	^{r}146,678	151,436	[3]149,000
Semimanufactures:[3]				
Sections	38,084	38,697	39,842	37,000
Wire rod	8,348	8,349	8,231	8,000
Pipe stock	5,872	5,845	6,071	6,000
Tubes from ingots	1,688	1,811	1,862	2,000
Plates and sheets:				
More than 5 millimeters thick	13,640	13,852	14,076	13,500
Other	18,929	18,907	20,076	19,500
Total	32,569	32,759	34,152	33,000
Strip	10,603	10,714	11,109	11,000
Railroad track material	3,945	3,943	4,143	4,000
Wheels, tires, axles	1,190	1,118	1,125	1,000
Unspecified shapes for sale	745	631	671	1,000
Other and unspecified	69	68	71	
Total	103,113	103,935	107,277	[3]103,000

See footnotes at end of table.

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Table 4.—U.S.S.R.: Estimated[1] production of mineral commodities —Continued

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978^p	1979^p
METALS —Continued				
Iron and steel —Continued				
Selected end products:[4]				
Total pipes and tubes[3]	r16,806	r17,021	17,553	18,200
Cold-rolled sheet[2]	6,943	7,054	7,017	7,000
Tinplate	612	612	600	600
Galvanized sheet	660	660	700	700
Electrical sheet[2]	1,151	1,154	1,173	1,000
Cold-reduced strip[2]	435	431	471	470
Wire, plain	3,850	3,850	3,600	3,500
Lead:				
Mine output, recoverable metal content	500	510	520	525
Metal, smelter:				
Primary	500	510	520	525
Secondary	100	100	100	100
Magnesium metal, including secondary	63	65	70	72
Manganese ore, gross weight[3]	8,636	8,595	9,057	9,500
Mercury metal, including secondary 76-pound flasks	56,000	58,000	60,000	61,000
Molybdenum, mine output, metal content tons	9,350	9,700	9,900	10,200
Nickel:				
Mine output, metal content	r135	r142	148	152
Metal, smelter	r155	r162	168	172
Platinum, mine output, metal content thousand troy ounces	2,800	2,900	3,050	3,200
Silver metal, including secondary do	44,000	45,000	46,000	46,000
Tin:				
Mine output, recoverable metal content tons	31,000	r33,000	34,000	35,000
Metal, smelter:				
Primary do	31,000	r33,000	34,000	35,000
Secondary do	11,000	12,000	12,000	12,000
Titanium:				
Concentrates:				
Ilmenite do	380,000	400,000	410,000	410,000
Rutile do	27,000	27,000	30,000	30,000
Metal do	32,000	35,000	37,000	39,000
Tungsten concentrates, metal content do	8,000	8,200	8,500	8,700
Vanadium do	8,000	9,000	9,500	10,000
Zinc:				
Mine output, recoverable metal content	720	735	770	770
Metal:				
Primary	720	735	770	770
Secondary	80	80	80	80
NONMETALS				
Asbestos	2,290	r2,400	2,435	2,470
Barite	400	450	475	500
Boron minerals and compounds:				
Gross weight	180	180	200	200
B_2O_3 content	90	90	100	100
Cement, hydraulic[3]	124,246	127,050	127,000	[3]123,012
Clays: Kaolin (including china clay)	2,200	2,300	2,400	2,500
Corundum, natural tons	7,500	8,000	8,500	[illegible]
Diamond:				
Gem thousand carats	2,000	2,100	2,150	[illegible]
Industrial do	7,900	8,200	8,400	8,500
Total do	9,900	10,300	10,550	10,700
Diatomite	420	430	440	[illegible]
Feldspar	280	290	300	310
Fluorspar	490	500	510	[illegible]
Graphite	95	95	100	100
Gypsum	5,000	5,200	5,300	5,400
Iodine	2	2	2	[illegible]
Lithium minerals, not further specified	45	50	50	50
Lime, dead-burned	23,000	23,500	23,500	24,000
Magnesite:				
Crude	3,600	3,700	3,800	3,900
Marketable product	1,800	1,850	1,900	1,950
Mica	43	44	45	[illegible]
Nitrogen, N content of ammonia[3]	10,090	10,744	11,300	12,300
Perlite	330	340	360	[illegible]
Phosphate rock:				
Crude ore:				
Apatite, 17.7% P_2O_5	37,000	41,000	42,300	44,700
Sedimentary rock, 13% P_2O_5	r17,000	r17,500	18,000	18,000
Total	54,000	58,500	60,300	62,700

See footnotes at end of table.

Table 4.—U.S.S.R.: Estimated[1] production of mineral commodities —Continued

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[p]
NONMETALS —Continued				
Phosphate rock —Continued				
Concentrate:				
Apatite, 39.4% P_2O_5	15,400	15,500	15,962	16,330
Sedimentary rock, 19%-25% P_2O_5	[r]8,500	[r]8,750	9,000	9,250
Total	23,900	24,250	24,962	25,580
Potash, K_2O equivalent	8,310	8,347	8,193	7,500
Pyrite, gross weight	7,000	7,000	7,400	7,400
Salt, all types	[r]14,300	[r]14,300	14,500	14,700
Sodium compounds, n.e.s.:				
Sodium carbonate	4,842	5,070	5,350	5,400
Sodium sulfate:				
Natural	310	320	330	340
Manufactured	220	230	240	240
Sulfur:				
Frasch	500	500	800	800
Other native	2,200	2,400	2,700	2,700
S content of pyrite	3,300	[r]3,500	3,500	3,500
Byproduct:				
Of coal	40	40	40	40
Of metallurgy	2,040	2,180	2,210	2,210
Of natural gas	870	920	1,100	1,100
Of petroleum	190	200	200	200
Total	9,140	9,740	10,550	10,550
Talc	440	450	470	480
MINERAL FUELS AND RELATED MATERIALS				
Coal:[5]				
Anthracite	77,739	79,000	79,000	79,000
Bituminous coal:				
Coking	183,000	185,000	185,000	185,000
Other (not further specified)	287,279	[r]291,000	293,000	288,000
Total "hard" coal	548,018	[r]555,000	557,000	552,000
Lignite and brown coal	163,504	[r]167,025	167,000	167,000
Coke: Coke oven, beehive, breeze, and gas coke	84,400	86,000	86,400	86,000
Fuel briquets:				
From anthracite and bituminous coal	1,350	715	700	700
From lignite and brown coal	7,204	7,840	7,302	7,300
Total	8,554	8,555	8,002	8,000
Gas, natural:				
Gross million cubic feet	11,950,000	12,884,000	13,852,000	[3]14,370,000
Marketed[3] do	11,334,295	12,218,923	13,136,994	13,600,000
Peat:				
Agricultural use	131,600	132,000	132,000	132,000
Fuel use	60,000	60,000	60,000	60,000
Oil shale	33,000	33,500	34,000	34,500
Petroleum:				
Crude:				
As reported, gravimetric units[6]	519,677	[r]545,799	571,531	[3]586,000
Converted, volumetric units thousand 42-gallon barrels	3,819,626	[r]4,011,623	4,200,753	4,307,100
Refinery products[7] [8]	383,190	392,722	403,048	415,000

[p] Preliminary. [r] Revised.

[1] Unless otherwise specified.

[2] 1976-78 data are from: United Nations Economic Commission for Europe. Annual Bulletin of Steel Statistics for Europe 1977, New York. V. 5, 1978, p. 21; and United Nations Quarterly Bulletin of Steel Statistics for Europe, New York. V. 29, No. 4, 1979, pp. 19 and 29.

[3] Reported in Soviet sources.

[4] Produced from semimanufactures listed above and possibly also from similar imported semimanufactures. Therefore, these data are not additive to total semimanufactures listed.

[5] Run-of-mine coal. The average ash content of coal shipped from mines was 20.2%, and the average calorific value was slightly more than 5,000 kilocalories per kilogram (9,000 Btu per pound) in 1977.

[6] United Nations. World Energy Supplies 1973-1978, New York. Ser. J, No. 22, 1979, p. 125.

[7] Not distributed by type and therefore not suitable for conversion to volumetric units. Data include all energy products and some nonenergy products as well as refinery fuel and exclude petrochemical feedstocks, paraffin, petroleum coke, white spirit, unspecified minor nonenergy products, and refinery losses.

[8] 1976-78 data are from United Nations. World Energy Supplies 1973-78, New York. Ser. J, No. 22, 1979, p. 148.

MINERAL TRANSPORTATION

Over 90% of 1979 mineral production was shipped by rail. The average transportation distances of selected mineral commodities shipped by rail and pipeline in 1978 follow, in kilometers: coal, 725; crude oil (by pipeline), 600; petroleum products (by pipeline), 585; iron ore, 795; coke, 830; ferrous metal, 1,410; and mineral fertilizers, 985.

The decree of the Central Committee CPSU and the U.S.S.R. Council of Ministers on "Measures to Develop Rail Transportation in 1976-80" named fuel as being the first among the high priority types of railway freight. Timely fuel delivery is viewed as a most important state task. Actually, rail transport has not been meeting targets with respect to raw coal and lignite and petroleum haulage, especially in the eastern coal regions of Siberia and Kazakhstan.

Rail transport, once a Soviet "succcess story," is increasingly acting as a spoiler of all other branches of the economy. Investment in the vast railroad network has been neglected in the recent past. The result is that the system is now undercapitalized and overloaded. Performance indicators, such as the average speed, turnaround times, and freight car utilization factors, have been deteriorating steadily. Railroad cars are hoarded by regional authorities with the result that shipments are delayed.

One of the country's biggest construction projects is the Baykal-Amur Railway (BAM), but with its completion the bottleneck in Western Siberia and westwards to the Urals, where there is only one line, will remain.

The U.S.S.R. has the sixth largest merchant fleet in the world and the largest number of general cargo vessels. It continues to expand, mainly to reduce the Soviet dependence on Western ships for the carrying of bulk cargoes. Fleet performance was expected to increase by more than 22% during the 1976-80 period. A net increase of 3.4 million deadweight tons in fleet capacity is planned for the same period after allowing for the retirement of 1.6 million deadweight tons.

The second section of the Vostochnyy (Nakhodka) terminal for oceangoing container ships was to be commissioned at the end of 1980. Like the first section, this will be fitted out with Japanese equipment. By the mid-1980's Vostochnyy will be the largest port of the Pacific Coast.

TRADE

The Soviet Union trades with 131 countries, and for 111 the trade is based on interstate agreements. The trade continues to be oriented towards imports of large quantities of Western industrial machinery and technology (including complete industrial plants) and substantial grain purchases. The Soviets rely heavily on both foreign Government-backed and commercial credits to finance the increasing foreign currency deficit. Exports of minerals help pay for these imports.

In the Soviet minerals economy, international trade is given high priority. Since the value and volume of trade are both outlined in the national plans, foreign trade reflects national goals and priorities. There is, therefore, an implied commitment to export to achieve a desired trade balance, and this can result in sales below world prices. Domestic consumer demand is a less important motivation than exports. Almost all exports could easily be consumed domestically.

Exports in 1979 increased 6.7 billion rubles to 42.4 billion rubles, while imports increased 3.4 billion rubles to 37.9 billion rubles. The centrally planned economy countries of the CMEA nations account for 52% of the Soviet foreign trade turnover in 1979 compared with 56% in 1978. The Soviet trade with developed countries grew by 31%, increasing from 20 billion rubles in 1978 to 26 billion rubles in 1979. Most active here are the Federal Republic of Germany, the United States, France, Japan, and Finland. Soviet trade with developing countries amounted to 11%, reaching a total of 9.5 billion rubles in 1979.

Fuels, mineral raw materials, and metals play the largest role in Soviet exports, representing over half of total official exports during 1979. Fossil fuels have been the top export category since 1974. Commodities falling within this classification include crude oil and petroleum products, natural gas, coal, and coke.

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creasingly accounts for the rapid growth in Soviet trade with Western countries, which more than quadrupled in the 1970-78 period, showing a rise of 15 billion rubles. The U.S.S.R.'s main exports to Western Europe are crude oil, petroleum products, and natural gas. Western Europe has been an importer of Soviet natural gas since 1968, when a branch of the Brotherhood Trunkline, which feeds Eastern Europe, reached Austria. Exports contracts have since been signed with Federal Republic of Germany, France, Italy, and Finland, guaranteeing shipments of natural gas over a 20-year period. Natural gas exports will soon become the Soviet Union's second main trade commodity (after petroleum). More than half of the hard currency earnings come from oil and gas sales. Shipments to France were scheduled to begin in February 1980 under a 4-billion-cubic-meter annual contract.

Soviet foreign trade continues to be oriented towards imports of needed machinery and equipment, including complete industrial plants. Also important are the substantial grain imports. In 1979, the volume of total official Soviet trade with leading Western developed countries, in billion rubles, was as follows: Federal Republic of Germany, 4.2: United States, 2.8; France, 2.6; Japan, 2.6; Finland, 2.6; Italy, 2.2: United Kingdom, 1.9; Netherlands, 1.1; Austria, 0.8; and Sweden, 0.8.

The Soviet Union adopts an unpredictable gold sales policy, presumably geared towards the international price. Estimated sales of Soviet gold decreased from 1978 to 1979. Despite the reduction, however, the value of gold sales in 1979 was about the same as in 1978. The absence of Soviet supplies of platinum-group metals over the past 2 years cannot be regarded as permanent, and export of platinum-group metals must return to normal levels in the future.

Exports of chromium have fallen, and the U.S.S.R. is withholding high-grade chromium supplies. Reportedly, the Rochester Gas and Electric Co. of the United States is to import $45 million worth of enriched uranium from the U.S.S.R. The import involves 94,600 pounds of enriched uranium to be imported over a 5-year period ending in 1984.

The U.S.S.R. provides nearly 100% of the Comecon countries' imports of crude oil, natural gas, pig iron, and electric power, about two-thirds of their petroleum products, rolled ferrous metals, and phosphorous fertilizers, about 60% of their coal and manganese ore, and up to 90% of their iron ore. Of the six East European members of Comecon, only Romania and Hungary do more business with the West than the U.S.S.R. Soviet exports of fuel and power to its Comecon partners in 1981-85 are to be 20% higher than under the 1976-80 plan. Most of this increase will probably consist of natural gas. For oil, iron ore, and other raw materials, the East Europeans pay the Soviets less than world market prices, and they pay in rubles. The Soviet Union's exports permit a controlling influence over the economies of its Comecon satellites. In Eastern Europe, this control rests largely on the fuels and energy trade. Romania is the only country producing moderate quantities of oil; all others are heavily dependent upon liquid fuel imports. The U.S.S.R. has a controlling influence over the metallurgical industries of the Comecon nations through exports of coke and ferrous and nonferrous metals. Soviet mineral import dependence is shown in table 5.

Table 5.—U.S.S.R. Net import reliance of selected minerals and metals as a percent of consumption in 1979

Commodity	Net import reliance (minus numbers show exports)	Principal sources
METALS		
Aluminum	-40	
Antimony	19	Yugoslavia.
Bauxite and alumina	55	Guinea, Yugoslavia, Hungary, India.
Cadmium	-29	
Chromium	-40	
Cobalt	0	
Columbium	0	
Copper	-30	
Gold	-100	
Iron ore	-20	
Iron and steel scrap	-3	
Lead	-10	
Manganese	-20	
Mercury	0	
Molybdenum	15	United States.

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Table 5.—U.S.S.R. Net import reliance of selected minerals and metals as a percent of consumption in 1979 —Continued

Commodity	Net import reliance (minus numbers show exports)	Principal sources
METALS —Continued		
Nickel	-9	
Platinum-group metals	-45	
Selenium	0	
Silver	-10	
Steel mill products	-2	
Strontium	0	
Tantalum	0	
Tellurium	0	
Tin	21	Malaysia, United Kingdom, Bolivia.
Titanium ilmenite	-9	
Titanium rutile	0	
Tungsten	12	Mainland China, Mongolia.
Vanadium	-5	
Zinc	-6	
NONMETALS		
Asbestos	-32	
Barium	51	Yugoslavia, North Korea, Bulgaria.
Cement	-3	
Gypsum	0	
Fluorine	50	Mongolia, Mainland China, Thailand.
Mica sheet	10	India.
Potassium	-42	
Pumice	0	
Salt	-2	
Sulphur	0	
MINERAL FUELS		
Natural gas	-5	
Petroleum	-35	

From a net exporter of steel and rolled products the Soviet Union became a net importer in 1978, and total steel imports are second only to grain in value.

The Soviet Union now buys two-thirds of all the large-diameter steel pipe manufactured in the Federal Republic of Germany, and it will import large quantities of Japanese pipe in the future. The Soviets planned to import some 0.7 million tons of Japanese large-diameter pipe in 1980.

Table 6.—U.S.S.R.: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)
(Users are cautioned that some data are incomplete; see footnote 1)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite	100	--	
Metal including alloys:			
Scrap	77,556	67,443	Austria 33,400; United States [illegible]
Unwrought	384,971	434,972	Hungary 147,482; Japan 111,118; Czechoslovakia 70,000.
Semimanufactures	5,581	17,537	Poland 9,400; Yugoslavia 4,798.
Arsenic:			
Trioxide, pentoxide, acids	3	--	
Metal including alloys, all forms	--	35	Yugoslavia 25; West Germany 10.
Cadmium metal including alloys, all forms	46	--	
Chromium:			
Chromite[2] thousand tons	673	738	United States 222; Czechoslovakia 126; Poland 122.
Oxides and hydroxides[2]	5,471	5,405	Czechoslovakia 500; Yugoslavia [illegible] Bulgaria 350.
Metal including alloys, all forms	115	767	All to Belgium-Luxembourg.
Cobalt oxides and hydroxides kilograms	--	65	Yugoslavia 50.
Copper:			
Matte	305	[3]900	All to France.
Copper sulfate[3]	20,786	21,194	Bulgaria 8,000; Hungary 4,[illegible]; Sw[illegible]erland 1,964.
Metal including alloys:			
Scrap	376	729	Austria 601.
Unwrought	78,476	58,332	Czechoslovakia 30,000; Netherlands 5,176; Finland 5,095.

See footnotes at end of table.

Table 6.—U.S.S.R.: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)
(Users are cautioned that some data are incomplete; see footnote 1)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Copper —Continued			
Metal including alloys —Continued			
Semimanufactures	2,535	1,728	Yugoslavia 1,540; Poland 184.
Germanium metal including alloys, all forms kilograms	--	300	All to Belgium-Luxembourg.
Iron and steel:			
Ore and concentrate[2] thousand tons	40,946	40,605	Poland 11,455; Czechoslovakia 10,863; Romania 4,373.
Roasted pyrite	48,896	85,555	Hungary 83,055.
Metal:			
Scrap[3] thousand tons	2,189	1,677	Italy 371; East Germany 351; Yugoslavia 315.
Pig iron do	3,076	3,228	Poland 1,527; Czechoslovakia 906; Bulgaria 392.
Ferroalloys do	129	132	Hungary 44; Poland 12; Finland 11.
Steel, primary forms do	732	758	Hungary 369; Yugoslavia 212.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	1,637	1,596	East Germany 682; Poland 618.
Plates and sheets do	1,085	951	East Germany 488; Hungary 262; Bulgaria 116.
Hoop and strip do	18	10	Bulgaria 6; Yugoslavia 3.
Rails and accessories do	2	1	Mainly to Yugoslavia.
Wire do	8	6	Hungary 5.
Tubes, pipes, fittings do	42	57	Yugoslavia 13; Hungary 9; West Germany 8.
Castings and forgings do	2	6	Afghanistan 3; Poland 2.
Total do	2,794	2,627	
Lead metal including alloys:			
Unwrought	39,498	32,303	Czechoslovakia 22,000; Finland 6,242.
Semimanufactures	NA	63	All to Cyprus.
Magnesium metal including alloys, all forms	3,279	2,779	West Germany 1,157; France 440; Japan 348.
Manganese:			
Ore and concentrate[3] thousand tons	1,352	1,186	Poland 446; Czechoslovakia 373.
Oxides	NA	10	All to Thailand.
Mercury 76-pound flasks	29	([4])	All to Austria.
Molybdenum metal including alloys, all forms kilograms	--	30	All to Japan.
Nickel:			
Matte and speiss	225	1,754	Sweden 1,566.
Metal including alloys:			
Scrap	2,023	--	
Unwrought	16,733	21,791	West Germany 6,939; Czechoslovakia 4,068.
Semimanufactures	139	232	Yugoslavia 228.
Platinum-group metals and silver:			
Ores and concentrates value, thousands	--	$14	All to Switzerland.
Waste and sweepings do	$222	$200	All to West Germany.
Metals, unworked or partly worked:			
Platinum-group do	$184,798	$224,677	Japan $147,306; United States $43,605.
Silver do	--	$32	Austria $30.
Tin metal including alloys, semimanufactures kilograms	--	27	All to Japan.
Titanium:			
Ore and concentrate	--	55	West Germany 50.
Metal including alloys, all forms	872	3,583	United States 2,644; West Germany 617.
Tungsten ore and concentrate	--	21,438	Yugoslavia 21,428.
Zinc:			
Ore and concentrate	--	2,718	All to Yugoslavia.
Oxide and peroxide	471	32	All to Japan.
Metal including alloys, all forms	29,639	29,450	Czechoslovakia 21,000; India 6,340[5].
Other:			
Ores and concentrates	18,632	17,990	Hungary 17,894.
Ash and residue containing nonferrous metals	42,878	50,401	Austria 50,224.
Oxides, hydroxides, peroxides of metals	1,277	1,166	Japan 374; West Germany 190; France 100.
Metals including alloys:			
Metalloids	2,676	2,704	Japan 2,060.
Base metals including alloys, all forms, n.e.s	20,503	20,796	Czechoslovakia 16,000; Austria 1,513.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc	461	355	All to Hungary.

See footnotes at end of table.

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Table 6.—U.S.S.R.: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)
(Users are cautioned that some data are incomplete; see footnote 1)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Abrasives —Continued			
Dust and powder of natural and synthetic precious and semiprecious stones value, thousands	$58	$889	United States $645; Italy $100; Yugoslavia $91.
Grinding and polishing wheels and stones	43	7	Finland 3; Turkey 2; Yugoslavia 2.
Asbestos	353,182	303,642	Poland 61,591; France 38,028; Hungary 33,174; Czechoslovakia 32,757.
Boron:			
Crude natural borates	3,034	3,979	Japan 3,969.
Oxide and acid	4,237	7,256	United States 2,665; Hungary 1,942.[3]
Cement, hydraulic[3] thousand tons	3,438	3,548	Hungary 489; Czechoslovakia 346; Iran 304; Poland 285.
Chalk	--	483	All to Finland.
Clays and clay products:			
Crude:			
Fire clay	10,819	7,891	All to Poland.
Fuller's earth and chamotte	9,801	26,029	Poland 25,913.
Kaolin	24,730	22,235	Poland 13,697; Yugoslavia 8,154.
Other	1,526	7,046	Italy 3,733; Hungary 3,024.
Products:			
Refractory[3]	131,667	129,280	Cuba 31,849; Bulgaria 23,041; Romania 21,329.
Nonrefractory	3,303	5,297	Finland 5,241.
Diamond:			
Gem, not set or strung value, thousands	$633,043	$380,447	Belgium-Luxembourg $164,657; West Germany $77,133; Netherlands $55,792.
Industrial do	$1,363	$753	All to Belgium-Luxembourg.
Fertilizer materials:			
Crude:			
Nitrogenous	--	293	All to France.
Phosphatic thousand tons	2,677	2,897	Bulgaria 738; Hungary 553; Poland 467.
Potassic	2,444	1,998	All to Hungary.
Manufactured:			
Nitrogenous[3] thousand tons	2,084	2,336	Cuba 569; Czechoslovakia 263; Hungary 231; India 222.
Phosphatic[3] do	628	703	Cuba 266; Bulgaria 196; Hungary 16
Potassic[3] do	6,024	5,771	Poland 2,384; Hungary 598; Czechoslovakia 331; Japan 312.
Other, including mixed do	43	79	Hungary 78.
Ammonia do	118	547	United States 277; Netherlands 8 Italy 66.
Graphite, natural	11,277	12,180	Japan 3,989; United States 3,319; Poland 3,275.
Gypsum and plasters	176,707	112,484	Sweden 60,600;[3] Denmark 29,692; Finland 20,675.[3]
Iodine kilograms	29	35	All to Hungary.
Lime	--	20	Do.
Magnesite	17,143	17,979	Netherlands 4,652; Finland 4,465; Japan 3,071.[3]
Pigments, mineral:			
Natural, crude	842	1,082	All to Hungary.
Iron oxides, processed	--	2	All to France.
Precious and semiprecious stones, natural and synthetic value, thousands	$1,946	$3,944	Austria $1,064; Spain $1,025; Japan $633.
Pyrite thousand tons	826	852	Italy 300; East Germany 91; West Germany 83; Hungary 81.
Salt[3] do	399	403	Hungary 161; Czechoslovakia 119; Denmark 38.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	NA	849	Afghanistan 717.
Caustic potash	--	2	All to Finland.
Soda ash	27,292	45,368	Italy 26,685; Hungary 6,959.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	18,475	15,894	West Germany 8,314; Italy 6,48
Worked	NA	1,309	Egypt 1,278.
Gravel and crushed rock	232	46,982	Hungary 44,520.
Quartz and quartzite	451	34	All to Japan.
Sand	734	436	Hungary 415.
Sulfur:			
Elemental, other than colloidal	44,159	29,606	Hungary 26,291; Yugoslavia 3,18
Sulfuric acid[4]	105,488	162,471	Czechoslovakia 140,162.
Talc	--	43	All to Japan.
Other:			
Crude	64,953	90,690	Spain 33,610; Belgium-Lu 24,002.

See footnotes at end of table.

Table 6.—U.S.S.R.: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)
(Users are cautioned that some data are incomplete; see footnote 1)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Other: —Continued			
Oxides and hydroxides of magnesium, strontium, barium	8,913	734	Netherlands 302; Finland 174; West Germany 153.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black[2]	87,994	39,262	East Germany 24,634; Bulgaria 24,072.
Coal, including briquets:			
Anthracite and bituminous coal thousand tons	21,726	17,676	East Germany 3,911; Czechoslovakia 3,179; Japan 2,483; Bulgaria 2,374.
Briquets of anthracite and bituminous coal do	23	888	Yugoslavia 884.
Lignite and lignite briquets do	67	48	Yugoslavia 46.
Coke and semicoke do	2,913	2,661	East Germany 960; Finland 754; Hungary 652.
Gas, natural million cubic feet	808,286	847,662	Italy 256,907; Czechoslovakia 202,246; East Germany 127,733; Austria 97,397.
Peat and peat briquets	125,623	167,544	West Germany 36,527; France 31,174; Italy 21,094.
Petroleum:			
Crude or partly refined thousand 42-gallon barrels	722,645	696,978	East Germany 130,586; Czechoslovakia 130,183; Poland 98,255.
Refinery products:			
Gasoline do	27,245	37,171	West Germany 10,285; Netherlands 8,288; United Kingdom 7,455.
Kerosine and jet fuel do	5,414	6,216	Hungary 1,585; West Germany 1,341; Netherlands 891.
Distillate fuel oil do	97,132	114,757	West Germany 29,460; Switzerland 19,254; Finland 10,772; Netherlands 10,101.
Residual fuel oil do	54,568	53,919	Sweden 13,686; Finland 9,171; Italy 4,649; Japan 3,969.
Lubricants do	220	1,396	Denmark 721; Yugoslavia 329; Spain 161; Austria 147.
Other:			
Liquefied petroleum gas do	2,150	2,848	Yugoslavia 1,311; France 682.
Mineral jelly and wax do	129	98	Finland 34; Italy 18; Austria 14.
Nonlubricating oils do	7,759	--	
Petroleum coke do	868	1,100	Italy 469; Japan 435.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals[3]	266,664	306,132	East Germany 41,852; France 41,181; Italy 17,318.

NA Not available.

[1] Owing to the lack of official trade data published by the U.S.S.R., this table should not be taken as a complete presentation of the U.S.S.R.'s mineral exports. Unless otherwise specified, data are compiled from the trade statistics of individual trading partners, as well as the United Nations 1977 Supplement to the World Trade Annual, v. I, Walker and Co., New York, and available trade statistics of member nations of the United Nations prepared by the Statistical Office of the United Nations.

[2] Official trade statistics of the U.S.S.R.

[3] World Bureau of Metal Statistics. World Metal Statistics, London.

[4] Less than one-half unit.

Table 7.—U.S.S.R.: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)
(Users are cautioned that some data are incomplete; see footnote 1)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite thousand tons	3,834	3,202	Guinea 2,280;[3] Greece 572; Yugoslavia 350.
Alumina oxide and hydroxide do	608	922	Hungary 894; United States 160;[3] Australia 100.[3]
Metal including alloys:			
Unwrought	962	1,769	United Kingdom 1,490; West Germany 225.
Semimanufactures	5,754	7,510	Austria 2,056; Japan 1,691; West Germany 1,216.
Antimony metal including alloys, all forms	280	810	All from Yugoslavia.
Beryllium metal including alloys, all forms	--	2	All from United Kingdom.
Bismuth metal including alloys, all forms	5	35	All from Japan.

See footnotes at end of table.

Table 7.—U.S.S.R.: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)
(Users are cautioned that some data are incomplete; see footnote 1)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Cadmium metal including alloys, all forms	155	--	
Cobalt metal including alloys, all forms	157	95	All from France.
Copper:			
Ore and concentrate	115,744	142,486	Canada 68,227; Philippines 41,325.[4]
Metal including alloys:			
Scrap	--	117	France 102.
Unwrought	18,113	10,988	Poland 7,256; Peru 1,480;[3] West Germany 1,433.
Semimanufactures	17,649	23,324	Yugoslavia 7,673; Poland 5,574; Japan 4,728.
Iron and steel metal:			
Pig iron	3,218	3,719	Sweden 3,029.
Ferroalloys	4,404	3,700	North Korea 2,956.[4]
Steel, primary forms	4,418	7,973	West Germany 7,552.
Semimanufactures:			
Bars, rods, angles, shapes, sections thousand tons	926	1,235	Spain 273; Belgium-Luxembourg 20; Poland 119.
Plates and sheets do	1,835	2,460	West Germany 1,233; Belgium-Luxembourg 293; Austria 244.
Hoop and strip do	204	278	West Germany 186.
Wire do	20	24	Belgium-Luxembourg 15.
Rails and accessories do	([5])	1	Mainly from Norway.
Tubes, pipes, fittings do	2,374	2,951	Japan 1,126; West Germany 955; Italy 506.
Castings and forgings do	7	3	Mainly from West Germany.
Total do	5,366	6,952	
Lead:			
Ore and concentrate	72,083	87,427	Iran 47,695;[4] Ireland 17,180.[4]
Oxide	626	1,073	North Korea 683;[4] France 199; Bulgaria 152.[4]
Metal including alloys:			
Unwrought	47,529	68,289	Yugoslavia 27,719; United Kingdom 11,235.
Semimanufactures	3	37	France 16; Yugoslavia 12.
Manganese:			
Ore and concentrate	--	10	All from Netherlands.
Oxides	5,802	4,000	Greece 2,000; Ireland 2,000.
Molybdenum:			
Ore and concentrate	380	4,370	United States 3,991.
Metal including alloys, all forms	([5])	89	United States 87.
Nickel metal including alloys:			
Scrap	32	34	All from United Kingdom.
Semimanufactures	11	157	United Kingdom 109.
Platinum-group metals and silver:			
Ores and concentrates value, thousands	$146	$5,711	Canada $5,611.
Metals:			
Platinum, unwrought or partly worked, not rolled do	$15	$21,600	All from Switzerland.
Silver, unworked or partly worked do	[6]$217	$2,937	Switzerland $2,936.
Tantalum ore and concentrate	NA	11	All from United States.
Tellurium, elemental	6	--	
Tin metal including alloys:			
Unwrought	2,834	5,619	United Kingdom 4,239.
Semimanufactures	--	2	All from United Kingdom.
Titanium oxide	1,342	1,788	West Germany 1,560.
Tungsten:			
Ore and concentrate	504	304	Netherlands 258.
Metal including alloys, all forms	33	46	Japan 36.
Zinc:			
Ore and concentrate	121,879	98,150	Iran 72,241;[4] Canada 18,387.
Oxide and peroxide	NA	159	United Kingdom 150.
Metal including alloys:			
Unwrought	37,950	37,753	Yugoslavia 20,513; Poland 15,72
Semimanufactures	4	2,522	Yugoslavia 2,520.
Other:			
Ores and concentrates	1,517	32,723	Norway 32,721.
Ash and residue containing nonferrous metals	1,068	106	All from United Kingdom.
Oxides, hydroxides, peroxides of metals	560	439	Finland 300; West Germany 70.
Metals including alloys:			
Metalloids	27,998	27,063	Norway 15,280; Yugoslavia 9,30
Base metals including alloys, all forms, n.e.s	2,147	1,465	Portugal 1,000; United Kingdom

See footnotes at end of table.

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Table 7.—U.S.S.R.: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)
(Users are cautioned that some data are incomplete; see footnote 1)

Commodity	1977	1978	Principal sources, 1978
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc	18	--	
Grinding and polishing wheels and stones	2,027	2,078	Austria 613; West Germany 405; Italy 389.
Asbestos	32	164	Denmark 108; Japan 56.
Barite and witherite	17,046	125,247	Turkey 113,558.
Cement thousand tons	[4]636	[4]592	North Korea 218;[4] Poland 210.
Chalk	7	--	
Clays and clay products:			
Crude, unspecified	465	1,309	Japan 1,000.
Products:			
Refractory	20,287	30,199	Japan 9,240; Austria 8,868; Italy 2,369.
Nonrefractory	7,241	3,961	Turkey 1,124; France 698; West Germany 696.
Diamond:			
Gem, not set or strung value, thousands	$77	$19	Belgium-Luxembourg $13.
Industrial do	$7,241	$1,013	Belgium-Luxembourg $996.
Diatomite and other infusorial earth	NA	1,074	Iceland 840; France 91.
Feldspar and fluorspar	NA	69,857	Thailand 30,500; Kenya 22,417; Morocco 15,640.
Fertilizer materials:			
Crude, nitrogenous	2,649	1,548	All from Bulgaria.
Manufactured:			
Nitrogenous	34,498	23,893	North Korea 15,869;[4] Afghanistan 7,288.[4]
Phosphatic	[4]43,982	[4]83,880	Sweden 47,900;[4] Yugoslavia 24,940.
Other, including mixed	--	180	All from United Kingdom.
Ammonia	--	8	All from Switzerland.
Graphite, natural	NA	150	France 130.
Gypsum and plasters	882	863	France 424; Yugoslavia 259.
Lime	30	326	Finland 226; Yugoslavia 76.
Magnesite, powder[4]	452,186	480,664	North Korea 478,554.
Mica, all forms	3	4	Japan 2.
Pigments, mineral: Processed iron oxides	3,020	1,363	Japan 780; West Germany 577.
Precious and semiprecious stones value, thousands	$334	$31	Canada $29.
Salt	--	55	Finland 52.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	37,427	34,334	Italy 32,218.
Caustic potash	100	52	United Kingdom 50.
Soda ash	500,276	425,688	Bulgaria 365,806.
Stone, sand and gravel:			
Dimension stone	1,202	1,341	France 565; Finland 372; Yugoslavia 208.
Gravel and crushed rock	357	28,401	Hungary 28,279.
Limestone	NA	161	Sweden 101; Finland 60.
Quartz and quartzite	689	30	All from Italy.
Sand	206	1,026	Finland 999.
Sulfur:			
Elemental, other than colloidal	754,029	639,957	Poland 635,000.
Sulfuric acid	74,843	73,400	Poland 73,083.
Talc	26,854	3,987	Finland 3,163.
Other:			
Halogens	--	40	All from Japan.
Oxides of magnesium, strontium, barium	16,946	181	West Germany 95; Japan 50.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	444	Finland 436.
Carbon black	[4]271	[4]705	East Germany 300;[4] West Germany 205.
Coal:			
Anthracite and bituminous coal thousand tons	9,120	9,880	All from Poland.
Lignite do	12,000	15,600	All from Hungary.
Gas, natural million cubic feet	410,700	[7]354,805	Iran 255,924; Afghanistan 98,881.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	27	1	Mainly from West Germany.
Kerosine do	368	420	Hungary 261; Italy 126.
Distillate fuel oil do	326	290	Hungary 172; Finland 71.
Residual fuel oil do	12	15	Mainly from Greece.
Lubricants do	247	219	Finland 57; France 45; Netherlands 28.
Other:			
Liquefied petroleum gas do	9	3	Mainly from Finland.
Mineral jelly and wax do	20	(5)	All from Italy.
Petroleum coke do	973	1,026	United States 825; Norway 201.
Bitumen and other residues do	5	3	Finland 2.
Bituminous mixtures do	9	24	Mainly from Finland.

See footnotes at end of table.

Table 7.—U.S.S.R.: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)
(Users are cautioned that some data are incomplete; see footnote 1)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	11,449	63,351	Japan 62,850.[4]

NA Not available.

[1] Owing to the lack of official data published by the U.S.S.R., this table should not be taken as a complete presentation of the U.S.S.R.'s mineral imports. Unless otherwise specified, data are compiled from the trade statistics of individual trading partners, as well as the United Nations World Trade Annual, Walker and Co., New York.

[2] Report of the U.S. Embassy to the U.S. Department of State on Guinea bauxite trade, Mar. 8, 1980.

[3] Metallstatistik (Metallgesellschaft) 1968-1978, Druckerei C. Adelmann, Frankfurt am Main.

[4] Official trade statistics of the U.S.S.R.

[5] Less than one-half unit.

[6] In addition to the value listed, the U.S.S.R. imported 64,000 troy ounces (value unreported) from Poland.

[7] Annual Statistical Bulletin 1978 of the Organization of Petroleum Exporting Countries. Druck: Bors & Müller, Vienna.

COMMODITY REVIEW

METALS

Aluminum.—The Soviet Union, second only to the United States in aluminum production, operated 14 primary reduction plans, with a total probable annual capacity of 2 million tons in January 1980. Production of alumina and aluminum fell short of the planned increase[17] because planned goals were not reached at the Krasnoyarsk, Regar, and several other plants, and output did not start at the new potline at the Tadzhik plant.

During the 1966-75 period, the output of aluminum grew by 220%. Under the present 5-year plan, output in 1980 was scheduled to be 20% to 30% above the 1975 level; the regions east of the Urals are to account for the entire increase. To achieve the goals, it is planned to put into operation several potlines at the Tadzhik and Sayansk plants and to complete construction of the Krasnoyarsk plant in Siberia. It is also planned to accelerate construction of additional alumina facilities at the Bogoslovsk and Uralsk plants in the Urals and at the Kirovabad plant in Azerbaydzhan. The Nilolayev alumina plant, with an annual capacity of 1 million tons, was to be completed by 1980. Due to slow construction and delays in the delivery of equipment, construction of the first half of the Regar plant in Tadzhikistan and the first potline at the Sayansk plant was deferred until 1980.

Aluminum is produced more for export than for domestic consumption, and the U.S.S.R. has exported approximately 500,000 tons in each of the past 6 years. Primary and secondary aluminum is exported to European countries, Japan, and the United States. Exports were expected to increase to about 600,000 tons in 1980.

The domestic wholesale price of different grades of aluminum is indicated by the following figures from Finansy S.S.R. (July 1978): A995 grade, 2,250 rubles per ton; A95, 1,050 rubles per ton; A85, 710 rubles per ton; A0, 630 rubles per ton.

Construction continued at the Krasnoyarsk, Regar (Tadzhik), and Sayansk primary aluminum plants. At Krasnoyarsk, the second largest aluminum plant in the country, one potline (No. 14) was completed in July 1978. Construction of the enterprise is nearing completion. The No. 2 potline at the Regar plant was commissioned in October 1978 and No. 3 in November 1979. It was planned to put into operation two potlines (Nos. 3 and 4) at this plant in 1979. Output of metal at the Regar plant has increased by almost one-third. Renovation of potlines at the Bratsk plant started in 1978. The first potline at this plant was commissioned in 1966 and the last one (No. 18) in 1976.

The first potline of the Irkutsk aluminum plant was brought onstream in 1962, and the last one (No. 8) was put into operation in 1971. The total probable capacity is 240,000 tons per year, and probable 1979 output was 200,000 tons. It is planned to increase capacity of this plant by 20% to 25% during the 1981-85 period. The plant produces aluminum wire and ingots. About one-third of production is exported. The plant's raw material comes from the Urals.

Reportedly, two contracts worth $4.3 million have been concluded between the Soviet Union and the Italian-based company Coe e Clerici, Genoa. The contracts provide for the supply of primary aluminum by the U.S.S.R. in exchange for aluminum foil from the Italian company.

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Table 8.—U.S.S.R. estimated capacity and production of primary aluminum plants

(Thousand metric tons)

Plant	Operations begnn	Probable annual capacity Jan. 1, 1979	Probable output 1978
Bogoslovsk	1945	140	120
Bratsk	1966	540	450
Dneprovsk	1933	70	60
Irkutsk	1962	240	200
Kanaker	1950	70	55
Kandalaksha	1961	30	20
Krasnoyarsk	1964	390	275
Nadvoitsa	1954	35	25
Novokuznetsk	1943	160	135
Regar (Tadzhik)	1975	60	35
Sumgait	1955	70	60
Uralsk	1939	135	120
Volkhov	1932	20	15
Volgograd	1959	125	90
Total		2,085	1,660

Although the Soviet Union is a large producer of low-grade bauxite, supplies are insufficient and it is developing alumina production from nepheline and alunite. The alumina is produced in the U.S.S.R. only at the Volkhov aluminum plant and at the Pikalevo complex in Leningrad Oblast' from the nepheline concentrates of the apatite complex in the Kola Peninsula and the Achinsk alumina plant from nepheline rock in Siberia. In 1978, over 79% of primary production was derived from bauxite, 18% from nepheline, and less than 3% from alunite.

Construction of reduction plants has outstripped the construction and expansion of alumina facilities. The Urals possess deposits of high-quality bauxite, and Soviet alumina production is concentrated at the Ural and Bogoslovsk aluminum plants. Alumina production in the Urals is being expanded by the new Bogoslovsk-2 alumina shop.

Production of alumina in Kazakhstan increased by 98% during the 1967-76 10-year period. It was planned to increase production of alumina in 1978 by 1.3% over the 1977 level and at the Uralsk aluminum plant, in particular, by 30,000 tons per year in 1978. In practice, additional facilities, with an annual capacity of 10,000 tons, were put into operation only at the Uralsk plant in June 1979. Because of poor recovery of alumina from nepheline rock at the Achinsk plant, it is planned to construct a nepheline concentration plant at this complex in the 1981-85 period. Construction of the Pikalevo No. 2 alumina-from-nepheline plant is also forseen for the 1981-85 period. The Achinsk alumina-from-nepheline plant achieved only about two-thirds of its designed capacity of the first stage (two lines). The second stage (three lines), which was under construction, was scheduled for completion in 1980.

The Kirovabad alumina-from-alunite plant in Azerbaydzhan started production in 1965 but has not reached its planned output. A massive capital investment was allocated to this plant for the 1976-80 period. New facilities for alumina-from-bauxite were commissioned at this plant in October 1978 and capacity of the plant increased by 50%.

Pechiney Ugine Kuhlmann is currently building an alumina plant at Nikolayev near Odessa on the Black Sea, following an agreement concluded in July 1976. The first stage of the plant was to be operating in 1980, and full production of 1 millon tons was planned for 1981. The alumina will be transported from this site some 6,000 kilometers to the Sayansk plant in Siberia. Reportedly, the plant is being built under a barter agreement, and Pechiney is to receive 500,000 tons of aluminum from the Soviet Union. According to Socialist Industry,[34] 6,000 workers were employed on construction in 1979. The first stage of the Dneprobugskiy bauxite port was put into operation in November 1979. The new port will handle bauxite for the Nikolayev plant.

Major reserves of presently minable bauxite are situated in the Turgay in Kazakhstan, on the eastern slopes of the Urals, and in the Tikhvin area of Leningrad Oblast'. About 75% of the reserves are in the Asian part of the U.S.S.R. Bauxite is the main source of alumina in the U.S.S.R., although the grade is frequently low and transportation often presents a problem. Large quantities of high-grade bauxite and alumina have been imported from Guinea, Greece, Yugoslavia, Hungary, India, and other countries. The U.S.S.R. buys around 30% of Greek bauxite exports. In 1978, the Soviet Union delivered 147,000 tons of aluminum in return for 394,000 tons of Hungarian alumina. The difference between exports of metal and imports of alumina is the sum Hungary paid to the Soviet Union for the smelting of its own alumina.

The Turgay bauxite open pits in Kazakhstan, the main supplier of raw material for the Pavlodar alumina plant, doubled ore production over the period 1968-76. The Verkhne Ashutak open pit of the Northern mine of the Turgay mine administration was put into operation in October 1978.

Development of the Belinsk mine at Turgay did not start until 1979, although completion had been planned for 1980. Although ten ESh 15/90 draglines and more than 50 BelAz trucks were in operation at Turgay in 1979, overburden removal was behind schedule. Shortage of housing, 33% turnover of workers, and low labor productivity resulted in poor performance of the Turgay group of open pits.[39] There are from 8% to 20% alumina losses during the processing of bauxite. The reserves of the Vezhayu-Vorykvin bauxite deposit in Komi A.S.S.R. and the Vislovsk deposit in Belgorod Oblast' were confirmed in 1978.

The U.S.S.R operated 15 secondary aluminum units with a total estimated annual capacity of 190,000 tons in 1978.

The U.S.S.R. has given financial and technical assistance for projects in Egypt, Guinea, India, Turkey, and Yugoslavia in exchange for bauxite and alumina. Reportedly, Jamaica has agreed to supply 250,000 tons per year of alumina to the Soviet Union under a long-term contract from 1984 onwards. Until then, the latter has agreed to purchase a minimum of 50,000 tons per year of alumina, starting in 1980. A feasibility report on the erection of an alumina plant, with a capacity of 60,000 tons per year, is to be submitted to the Indian Government.

Discussion on construction of an alumina plant in Greece by the U.S.S.R., with an annual capacity of 400,000 tons, continued in 1979. The anticipated yearly production would be imported by the Soviet Union as payment, and some may go to Bulgaria and Poland.

The Soviet Union has helped Guinea to develop a bauxite mine. It has also agreed to carry out feasibility studies on a proposed 600,000-ton-per-year alumina plant for Guyana's State-owned Bidco.

Antimony.—The Kadamzhay complex in the Kirgiz S.S.R. is the principal antimony center, where integrated facilities produce most of the country's refined products. Output at this complex was to increase by 50% in the 1976-80 plan period.

Construction of the new Aznob mine and mill unit (Dzhidzhikrutskiy complex) in Tadzhikistan continued slowly in 1978-79. Completion of the first stage was scheduled for 1975 but was rescheduled for 1980. Deposits of antimony also occur in Kazakhstan and Sarylakh and Tazhdolinsk in Siberia. Production of antimony at the Ust'-Kamenogorsk lead-zinc complex increased slightly in 1979. Detailed exploration of the Novoye antimony-mercury deposit in Kirgiziya continued in 1979. The wholesale price of antimony in the U.S.S.R. is 2,350 rubles per ton for SU0 and 1,850 rubles per ton for SU2.

Arsenic.—Arsenic ores contain 0.2% to 0.5% As_2O_3. Small arsenic deposits are located in Tadzhikistan, but all output in 1978-79 was obtained as a byproduct from the smelting or roasting of metallic ores. The only plant in the U.S.S.R. to recover arsenic from sulfur has been installed at the Mednogorsk copper and sulfur complex in Orenburg Oblast'.

Beryllium.—The Soviet Union continues to be one of the world's largest producers and consumers of beryl, beryllium alloys, and metal. Beryllium is found in variable quantities in most of the pegmatites all over the U.S.S.R. There are numerous deposits mainly in Kola Peninsula, Kazakhstan, Urals, Altay, Transbaykal, Soviet Far East, and Western Ukraine. Domestic reserves are more than adequate. Production is being expanded. It is planned to recover beryllium from the Dzhidinsk tungsten and molybdenum ores in Buryat A.S.S.R.

Bismuth.—Bismuth is recovered as a byproduct of lead and zinc smelting in Kazakhstan and other areas in the Soviet Union, from dust and crude metal at the Balkhash, Kirovograd, and Mednogorsk copper complexes, and from tungsten and molybdenum ores. Two copper bismuth deposits (Taryzkan and Kantarkhana) are under exploitation in Tadzhikistan. The Ustarassy mine in the Chatkal Mountains is the only enterprise to mine bismuth ore. Its concentrates are shipped to the Chimkent lead plant in Kazakhstan for processing.

Renovation and enlargement of bismuth production facilities at the Dalpolimetall lead complex in the Primorsk Kray began in 1979. In 1980, the complex is to begin receiving bismuth-bearing ore.

Cadmium.—Cadmium is produced at various lead and zinc smelters and at some copper complexes as a byproduct. Kazakhstan continues to be the national leader both in reserves and production, and the Leninogorsk polymetallic complex there is one of the largest producers. Average overall Soviet cadmium recovery was about 50%.[41]

Chromium.—The U.S.S.R. continued to be the world's second producer and exporter of chromite in 1978-79. About 75% of exports were destined for market-economy countries. Approximately 70% of the output was consumed or stocked in the Soviet

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Union. Based on 1978 data, Soviet consumption of chromite was distributed as follows: Metal production 45%, refractories 35%, chemical and other products 20%.

Chromium ores are situated at Kazakhstan and in the Ural Mountains. The Donskoye operation at Khrom-Tau in Western Kazakhstan, which produces 95% of the Soviet output, is the only supplier of high-quality ore. Deposits in the Ural Mountains have a low chromium oxide content (20% to 40%), as well as a low Cr_2O_3:FeO ratio. These are mostly used in the chemical and refractories industries. It was planned during the 1976-80 period to put into operation new facilities for production of 2.55 million tons per year of crude ore. Development of the open pit at the "40-years of Kazakh S.S.R." mine was nearing completion. For transportation of overburden, M-120 Unit Rig dump-trucks (109-ton capacity) are used.

Currently, the south Kempirsay chromite deposits are being mined by the Ob'yedinennyy mine (Millionnyy, Gigant, and Geofizicheskiy open pits), the 20th Anniversary of the Kazakh S.S.R. mine (Yuzhnyy open pit), and the 40th Anniversary of the Kazakh S.S.R. mine (open pit of the same name and the Molodezhnaya underground mine, which is under development). Beside these large deposits, the small, shallow Spornoye, No. 16, No. 28, No. 29A, and Geofizicheskoye V deposits are currently being mined or are under development for surface mining. For the mining of deep parts of the "Millionnoye," "Almaz-Zhemchuzhina," "Pervomayskoye," and No. 21 deposits, the Tsentral'naya underground mine will be developed. Mines for the extraction of chromite ore from a maximum depth of 1,200 meters are under development at the Donskoye mining and concentration complex in Aktyubinsk Oblast'.

Marketable ores include those with a chromium oxide content of at least 45%, a maximum silica content of 10%, and a maximum lump size of 300 millimeters. Ore preparation at the Donskoye mining and concentration complex consists of crushing, grading, and handpicking. Rich and lean ores are blended. From 1974 through 1978 (first stage of the plant began operation in 1974), 1,556,000 tons of feed material with a chromium oxide content of 42.8% was processed, and 973,000 tons of concentrate with a chromium oxide content of 50% to 56% was obtained. Designed capacity of the gravimetric concentrator is 1 million tons per year of feed.

During the 1975-77 period, the concentrator's marketable output increased by 110%, reaching 435,000 tons, with an average chromium oxide content of 49.8% in 1978. It was planned in 1978 to put into operation additional annual capacities of 700,000 tons of crude ore, to accelerate development of the Molodezhnaya underground mine, and to attain the planned output of the concentration plant, by producing 575,000 tons of concentrate (30% over the 1977 level) with an average chromium oxide content of 50.8%. These targets were not met, however. Output of marketable chromite from the Saranov underground operation in the Urals is estimated at about 5% of the total Soviet production.

Cobalt.—Cobalt reserves are chiefly in nickel-cobalt ores and in cobalt ores of the Khovu-Aksinsk deposit in the Tuva Autonomous Republic. Production continues to be concentrated at Norilsk in East Siberia; at Monchegorsk and Pechenga on the Kola Peninsula; in the Urals at the Yuzhuralnikel, Ufaley, and Rezhsk plants; and at some copper plants. Recovery of cobalt remains low, especially from the copper pyrite ores of Bashkiria. The planned production cost of cobalt in concentrate at the Pechenganikel complex was 6,780 rubles per ton.

Cobalt production rose by 16% between 1970 and 1975, and probably increased by a similar amount during the 1976-80 period. The planned increase of cobalt production at the Norilsk complex by 5.8% was not met in 1979. Since the beginning of 1976, capacity of the Tuva cobalt complex almost doubled as a result of renovation. During the 1975-78 period, production of cobalt at the Norilsk complex increased by 35%.

Large quantities of Cuban nickel-cobalt concentrates have been shipped to the Soviet Union.

Copper.—There are 13 smelters, with a total probable annual capacity (January 1978) of 1.1 million tons, and 13 refineries in operation in the U.S.S.R. The secondary blister copper is produced by the Kirovgrad smelter in the Urals, by the Moscow smelting and electrolytic plant, and by several small units of secondary nonferrous plants. The wholesale prices of copper-ingot are CBIA, 890 rubles per ton; CH1 and CH2, 860 rubles per ton. Exports of copper increased from 123,000 tons in 1970 to 205,618 tons in 1975. Estimated exports in 1980 are 250,000 tons.

Under the 10th 5-year plan, output of copper in 1980 was scheduled to be 20% to 30% over the 1975 level. The plan provided for 80% of production to come from the Asian part of the U.S.S.R. by 1980. The

1976-80 plan called for a 25% increase in refined copper production in Kazakhstan. The planned targets for copper production in this Republic were not met in the 1976-79 period. Soviet planned output of copper in 1979 was not attained.[43] Some evidence indicated that the 1980 copper production in the Soviet Union would amount to about 1 million tons. Over the period 1976-80, the increment would be about 14%. Production is estimated at a probable 1.1 million tons in 1985 and 1.3 million tons in 1990.

Reverberatory smelting continues to be the main process, and the change over to natural gas fueling has improved conditions for workers and made it possible to improve copper extraction. At the Almalyk complex in Uzbekistan and Sredneuralsk plant in the Urals, the use of oxygen in the reverberatory furnaces made it possible to improve the melting of the charge by 20% to 25%. Plans are to replace reverberatory smelting of blister by the oxygen-flash process at the Krasnouralsk plant in the Urals.

The country operates 40 concentrators with a total probable annual capacity of about 5 million tons of concentrates. Production of concentrates in 1979 has been estimated at 4 million tons with an average copper content of about 20% (from 12% to 36%). Sixty-five underground mines and open pits produced an estimated 125 million tons of ore in 1979. Approximately 80% of all ore was mined by open pit methods. Up to 10% of primary copper is produced as a byproduct.

The main copper ore regions are located in Central and Eastern Kazakhstan, the eastern slope of the Ural Mountains, Uzbekistan, the Transcaucasus, Eastern Siberia, and Norilsk. Among other regions containing copper deposits of lesser importance are the Northern Caucasus, Western Siberia, and the Kola Peninsula.

Kazakhstan contained about half of the total copper reserves in 1979 and is the main producer. There are 48 known copper deposits in the Republic, of which 19 (containing two-thirds of the Republic's copper reserves) were under exploitation in 1979. Important copper deposits are located in four main areas: Dzhezkazgan, Kounrad, Boshchekul, and the Altay. The 1976-80 5-year plan called for a 25% increase in refined copper production in Kazakhstan. During the past decade copper ore mining increased by 30% but planned targets for production were underfulfilled in 1976-79.[43] The Irtysh copper smelter has been under construction for 12 years and only 25% has been completed.[44] At the pilot plant of this complex, a Kivset process for treating copper-zinc sulfide concentrates was tested.

During the 1976-78 period, output of blister copper at the Dzhezkazgan complex in Kazakhstan increased by 17% and that of refined copper by 20%. There are three underground mines and one open pit in operation. Development of the Annensk mine at this complex continued in 1979. At the Balkhash complex, the largest copper producer in the U.S.S.R., the assembly of a nonferrous metal rolling mill was completed in January 1978. Construction of a new copper smelter at the Irtysh complex in Kazakhstan, which started in 1968, continued in 1978-79.

The Kounrad and Sayak mines are the main suppliers to the Balkhash complex in Kazakhstan. Four open pits (Sayak-I, Sayak-II, Sayak-III and Tastau) were in operation at Sayak. Expansion of the Sayak open pit at the Balkhash complex continued. The Sayak No. 4 open pit was put into operation in August 1979. Construction of the Zhezkentskiy complex, Nikolayevsk concentration plant and development of the Nikolayevskiy open pit in Kazakhstan continued in 1979. Exploration of the Koksayskoye copper deposits in Kazakhstan has been completed. Exploration in the Republic continues, but shortages of drilling rigs and trucks have limited operations.

The Ural region occupies second place as a copper producer. The deposits are mostly copper pyrites and contain zinc, gold, silver, and other metals. There are over 100 individual pyrite deposits in the Urals. Copper ore is surface-mined at Uchalinskiy, Mezhozerskiy, Sibayskiy, and Gayskiy and deep-mined at Degtyarsk, Karabash, Gayskiy, Imeni III International, and Levikhinskiy. With the development of the Gayskiy, Uchalinskiy, and Ob'edinennyy open pits of the Uchalinskiy complex and the decline of the Degtyarsk, Krasnouralsk, and Karabash underground mines, the proportion of open pit ore has increased from 39% in 1958 to 75% in 1979. This trend is expected to continue. The Krasnoural'sk, Kirovograd, and Karabash copper smelters in the northern Urals have experienced major shortages of concentrates, and one-third of their feed has been transported from Central Asia, the Altay region, the Caucasus, and other regions. It is planned to increase production of ore at the Gayskiy complex by development of a 1,200- to 1,600-meter-deep mine.

Uzbekistan holds third place; the copper-porphyry occurrences near Almalyk and

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Kalmakyr are of great industrial significance. The Almalyk complex is one of the largest copper-producing centers in the U.S.S.R., and it is planned to invest 29 million rubles to double ore production in the future by development of the newly discovered and explored Dal'neye and other deposits. It is also planned to replace the reverberatory furnace at the Almalyk complex with a second oxygen-flash smelting furnace by 1984. It is expected to increase output of copper at this complex by 40%.

The Zangezur copper-molybdenum complexes and the Alaverdy metallurgical plant in Armenia showed a poor performance in 1979. The planned production goals were not met, and copper recoveries were much below design expectations. A new level, No. 950, was added to the open pit of the Zangezur copper and molybdenum complex. The copper concentrates from Kadzharan, Agarak, Madneuli, and Urup mining and concentrating complexes are shipped to the Alaverdy complex.

During the 1976-80 period, extraction of ore at the Bashkirskiy copper and sulfur complex in the Urals was to be increased by 37% and processing of ore by 30%. Assembly of shovels began at the Uchaly mining and beneficiation complex in Bashkiria, where the third open pit, the Molodezhnyy, is being developed for the production of copper and zinc. The first shafts for underground mining are also being sunk.

During the 1975-78 period, output of refined copper at the Norilsk complex increased by 7.2%. It was planned to increase production of refined copper by 3.2% in 1979. The country's deepest shaft, at the Taymyr copper-nickel deposit of this complex, has been sunk to the planned depth of 1,415 meters. A parallel ventilation shaft is now being sunk. Construction of the Norilsk No. 2 copper and nickel smelters with Finnish technical assistance continued in 1979. Flash smelting plants for copper and nickel from Outokumpu Oy, Finland, have already been delivered. The smelters' capacity will be 650,000 tons per year of copper concentrate (200,000 tons copper) and 550,000 tons per year of nickel concentrate (100,000 tons nickel). Completion of the first stages was scheduled for 1980. The first stage of the Nadezhda complex to produce copper-nickel concentrates (Norilsk No. 2 copper and nickel smelter), which has been under construction for 8 years, was commissioned in October 1979.

The first stage of the anode plant at the Severonikel complex in the Kola Peninsula was completed in 1978. A blister copper smelter is under construction at the Solnechnyy complex in Khabarovsk Kray. It is to be commissioned at the beginning of the 1981-85 5-year plan. Byproduct copper concentrates are produced from the polymetallic ores of 14 deposits in Tadzhikistan.

Copper reserves of the country in 1979 averaged 1.1% Cu. The reserves are chiefly in low-grade cupriferous sandstones and porphyries but also include high-grade pyritic-polymetallic ores, copper-nickel ores, and smaller quantities of copper-molybdenum and miscellaneous ore types. The gross reserves of the Udokan copper deposit in Eastern Siberia, which has not yet been exploited, amount to over 700 million tons averaging 1.15% copper (20% oxides, 80% sulfides). It is planned to develop this deposit in 1981-90. The Soviet Union has been negotiating from time to time with British, French, and Japanese companies to develop the Udokan deposit "jointly". Reportedly, the Soviet Union asked Japanese firms for loans, technology, and equipment to develop the deposit at the last meeting of the Japan-Soviet economic committee in March.

Practically all of the Soviet copper reserves are in Asia, east of the Urals watershed and south of the Great Caucasus. Exploration for additional reserves is continuing on a large scale. With the exception of the partially depleted copper districts of the eastern Urals, the sources of copper are at considerable distances from the densely populated and highly industrialised European part of the country. This situation is partly responsible for the slow rate of development.

Gold.—Since the early 1930's, few data on Soviet activities in precious metals exploration, production, trade, and stockpiles have been published officially. Available information, however, indicates that in 1979 the U.S.S.R. was probably second among world producers. Over two-thirds came from the Soviet Far East and East Siberia (mainly from placers at Kolyma, Aldan, Dzhugdzhur, Indigarka, Yana, and Chukotka); most of the balance came from gold and polymetallic ores in the Urals, Kazakhstan, Armenia, Uzbekistan, and West Siberia. Substantial quantities are produced as byproduct at nonferrous operations.

Soviet gold production has maintained a steady growth rate. Prompted by the higher international prices, the U.S.S.R. plans to increase production and has been importing large-scale equipment from West Europe, the United States, South Africa, and Japan. Based on ore reserves, geological and mining conditions in the country's largest gold-producing regions, and fragmentary, indirect reporting, production was estimated at

8.2 million troy ounces for 1980.

Soviet gold holdings are secret. Current production does not automatically reach the world market for gold. Soviet sales are conditioned by both economic and political considerations. Throughout the 1970's, the U.S.S.R. has managed its gold sales to the West carefully, and it is likely that this policy will continue. In the past, gold sales have been used occasionally to finance emergency grain imports. With the price of gold soaring to new heights in the world market, it is conceivable that the Soviet Union may use gold revenues to pay for the import of Western equipment to finance hard-currency trading deficits. At the beginning of 1979, the Soviet net hard-currency debt was estimated at over $11 billion.

Dealers estimated Soviet gold sales in 1979 at some 200 tons, about half of the 1978 figure. The Soviet gold enters the markets mainly in Zurich, Frankfurt, and London. Soviet gold and platinum-group metal sales strategy will be critical in shaping world prices of the 1980's. Official gold sales are declining as prices increase.

Although Soviet sources report reserves sufficient for 12 to 15 years at present rate of production, extensive prospecting continues. Several big mines are suffering from lack of reserves, and new mines have been opened in the northeastern parts of the Soviet Far East and the Yakut A.S.S.R. In view of the importance of gold, an intensive search is in progress in the Asian part of the country.

Magadan Oblast' is the main producing center with 35 placer mines, 23 dredges, over 500 sand-washing rigs, and about 1,500 bulldozers. Although the Soviets built the world's most northerly Bilibino nuclear powerplant specifically for the mineral industry, the mines are still primarily dependent for power on diesel generators, and this frequently causes lost gold production. Construction of the Dukat complex in the Omsukchansk County of this Oblast' was begun 11 years ago. More than 12 million rubles have been spent on construction, but due to lack of personnel and shortages of supplies the construction quota for 1979 was not met. Construction of the Karamken mining and concentration complex in Khasinsk County was completed in March 1978. This is the first enterprise in Magadan Oblast', that will extract gold and silver from ore. Completion of this complex was behind schedule for many years.

Development of the Muruntau deposit in Uzbekistan, which was discovered in 1960, continued in 1979. The Muruntau open pit was over 100 meters deep in 1979, and the overburden-ore ratio was 35:1. Special attention was paid in 1979 to improving technology of gold recovery at the Ararat plant in Armenia, which is fed by ores from the Zod deposit. In Yakutia, the second largest gold-producing region, the Lenzoloto Trust was the leading gold-dredging enterprise. The deepest shaft (890 meters) in the Soviet gold-mining industry was under development at the Bestube mine in Tselinograd Oblast' in Kazakhstan.

The Soviet Government has issued its first gold coin of 100 rubles. Soviet production of Olympic gold coins will be limited to 130,000 pieces. The face value sales of the coins outside the U.S.S.R. are expected to reach $150 million according to Soviet sources.

Iron Ore.—In 1979, 71 underground mines and 64 open pits, with a total estimated capacity of 297 million tons of usable iron ore, produced less of direct-shipping ores plus concentrates compared with the 1978 level. There were 92 iron ore concentrators, of which 29 had sinter facilities and 7 had pelletising facilities in operation (Sokolov-Sarbaysk, Kachkanar, Lebedinsk, Kremenchug, and 3 in Krivoy Rog) with a total annual capacity of 37 million tons.

Production of usable ore is scheduled to reach 276 million tons (crude ore 560 million tons) in 1980, compared with 233 million tons in 1975, an increase of about 19%. Output of iron pellets was planned to increase from 27 million tons in 1975 to 62 million tons in 1980. To achieve the planned targets, the following capacity increases were to be accomplished during the 1976-80 period: For usable iron ore, 115 million tons; and for sinter and pelletised concentrate, 22.5 million tons. It was planned to increase capacities at the Lebedin, Mikhaylov, Stoylev (Kursk Magnetic Anomaly-KMA), Dneprov, Northern, Central (Ukraine), Kachkanar (Urals), Kovdor, and Olenogor (Polar region) mining and concentration complexes and to achieve the rated capacities at the Kazsk, Sheregesh, Sokolov, and Bakal underground mines.

Although a large exporter of iron ore, the U.S.S.R. has continuous problems supplying its own plants, both quantitatively and qualitatively. The principal importers of Soviet iron ore are Poland, Czechoslovakia, Romania, Hungary, the German Democratic Republic, and Bulgaria, which represent about 90% of the total Soviet exports.

The iron content in crude iron ore decreased from 50% in 1950 to 44.5% in 1960, 37.3% in 1970, and 35.1% (planned) in 1980. As a result, the ratio of ores subject to

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beneficiation increased from 37% in 1950 to 86.6% in 1978.

Open pit mining is used in about 74% of the total volume of usable iron ore. In 1978, there were 13 pits, 150 meters deep and more, including 7 pits over 200 meters deep (250 to 265 meters at the Sokolovskiy and Sarbayskiy pits). The main underground mining regions are the Krivoy Rog Basin in Ukraine (60%), Gornaya Shoriya in Western Siberia (16.7%), and the Tagilo-Kuvshinskiy region in the Urals (16.4%).

The total iron ore reserves in place in the $A+B+C_1+C_2$ categories are 111 billion tons (as of January 1, 1976), averaging 34.8% iron. These were distributed as follows: Ukraine 31%; European Centre 24.4%; Urals 15.7%; Kazakhstan 15.0%; Siberia 7.4%; Northwest 3.0%; Soviet Far East 2.5%; and others, 1%. Total national reserves in categories $A+B+C_1$ were estimated at 60 billion tons of ore averaging 38% iron. This figure included 10 billion tons of ore, averaging over 55% iron, which does not require dressing, and 34 billion tons of easily dressed iron ore.

The Ukraine produced over 50% of Soviet iron ore, and the Krivoy Rog Basin produced about 89% of Ukraine's total in 1979. The Kursk region was the second largest producer, followed by the Urals, Kazakhstan, Siberia, and the Kola Peninsula. There were 23 underground mines (10 mining administrations), 9 large, and several small open pits in operation in Krivoy Rog in 1979.

During the 1976-78 period, the following capacities were commissioned at the Dneprovskiy complex (Kremenchug) in Poltava Oblast', Ukraine: 12.5 million tons per year of crude ore, 4.0 million tons per year of concentrate, and 6 million tons per year of pellets. In 1979, facilities for output of 3 million tons of crude ore and 14 million tons of concentrate went onstream. The design capacity of this complex is 34 million tons of crude ore, and 14 million tons of concentrate. At the Severnyy mining and concentration complex in Krivoy Rog, installation of equipment began in another two concentration sections with a total capacity of 1.5 million tons of iron ore concentrate a year. They were to be put into operation by the beginning of 1980, increasing annual capacity to 19 million tons of concentrate.

Some 40 million tons of crude iron ore was produced in the Kursk region in 1979. It was planned to reach 47 million tons by 1980. There were four iron ore producing enterprises in this region in 1979: The KMAruda complex, the first stages of the Lebedin and Mikhaylov complexes, and the Stoylensk open pit. Development of the Yakovlevsk underground mine, which began in 1974, is proceeding slowly, and the sinking of the second shaft (700 meters deep) started in 1979. The Lebedin complex did not meet production targets for any year of the 1976-79 period.

There are shortages of iron ore in the Urals, and over 10 million tons of ore are shipped annually to the Urals from KMA and other regions of the country. Iron ore production in Kazakhstan accounted for 9% of the total, mainly from the Sokolov-Sarbay complex, with an annual capacity of about 30 million tons of crude ore (13 million tons of concentrate and pellets). Facilities for mining of 1 million tons of crude ore and production of 0.4 million tons of concentrate were put into operation at the Kovdorslyuda (Kovdor mica) complex in Murmansk Oblast' in August 1979.

According to an October 1973 agreement, Finnish companies are building the Kostamush iron ore complex in Soviet Karelia about 30 kilometers from the Finnish border. This project will be built in three stages and will have an annual capacity of 8.9 million tons of pellets (24 million tons of crude ore). Construction of the first stage for the production of about 3 million tons of pellets per year began in 1977 and will continue until 1982. Finland will buy up to 1.2 million tons of pellets per year during the 1983-90 period. The deposit contains an estimated 1,200 to 1,500 million tons of ore with an average iron content of 31%. Construction will take from 8 to 10 years. When the first stage is completed, production will be 3.0 million tons of pellets annually from 3.3 million tons of concentrate (8 million tons of crude ore).

Iron and Steel.—While the Soviet Union is the largest steel producer in the world, it may also waste more steel than any other country. According to the various published accounts in the Soviet press, the Soviet industry in 1979 used only 73% of the rolled steel which it consumed, with the remaining 27% being wasted. There is also considerable wastage in the production of steel. Additional use of continuous casting processes could save 1 million tons of steel each year. A careful and exhaustive study of Soviet publications shows that only about 45% of the total crude steel production is efficiently used in the Soviet economy; 55% is remelted or lost.

The 10th 5-year plan called upon the steel industries to increase output quantitatively and qualitatively. Production of crude steel was to increase from 141 million tons in 1976 to between 160 and 170 million tons in 1980. Production of finished rolled steel was to increase from 99 million tons to between 115 and 120 million tons. It appeared unlikely that these quantitative and qualitative goals would be achieved, and that production of steel and finished rolled steel would probably be below 160 million tons and 115 million tons respectively.

Of 126 projects under construction and due to come onstream in 1978, only 93 were actually completed. Construction lagged and still is lagging at a number of important projects, including Lebedin, the Northern and Southern iron ore mining and concentration complexes, the equipping of electrosteel shops at the Donetsk and Uzbek metallurgical plants, and the ferromanganese smelting furnace at the Nikopal plant.[45] The construction of the No. 6 blast furnace (3,200 cubic meters, 2.2 million tons per year of pig iron) at Lipetsk was completed in November 1978.

The cost of increasing crude steel output is considerable. Estimates in Soviet publications range from some 600 million rubles to 1 billion rubles per 1 million tons of increased output. At these prices, boosting raw steel output to the 10th 5-year plan levels would consume most, if not all, of the industry's capital investment funds, which should be some 16 billion rubles over the 5 years.

In 1979, 36 enterprises, operating 138 blast furnaces, did not meet planned production quotas of 114.3 million tons of pig iron. The average blast furnace capacity increased from 1,135 cubic meters in 1971 to 1,258 cubic meters in 1979. About two-thirds of all blast furnaces use oxygen for enrichment, over 83% of the pig iron was produced by partial use of natural gas, and 75% was produced by use of oxygen. It was planned to produce 115 million metric tons of pig iron in 1980.

Renovation of the third blast furnace of the Novolipetsk metallurgical complex was completed in August and No. 1 of the Chelyabinsk complex in October 1979. As a result of an inadequate supply of raw materials, there are production shortcomings at the blast furnaces of the Chelyabinsk complex.[46] The majority of the blast furnaces at the Ukrainian metallurgical plants are operating below their capacities.

Enlargement of the converter shop at Nizhniy Tagil was completed on December 31, 1978; the shop's annual production capacity has been increased by 0.6 million tons. The 120-ton converters have been replaced by new ones of 160-ton capacity. Renovation of the first converter shop of the West Siberian metallurgical works was completed in December 1978. The converter's capacity has increased 0.5 million tons annually. The second oxygen-producing plant, with a capacity of 30,000 cubic meters of oxygen per hour, was commissioned in May 1978.

Construction of the first section of the first stage of the oxygen converter shop (two units, each 350-ton capacity, with the construction cost of 180.4 million rubles) at the Cherepovets plant was not completed in 1979. The total designed capacity of all stages is 5 million tons of steel per year. Construction of a big oxygen converter shop at the Dzerzhinsk works in the Ukraine began in 1978. The first section of the complex was to be commissioned in 1980. It was planned to complete construction of No. 4 oxygen converter at Nizhniy Tagil complex in 1979. Because of the shortage of pig iron, open-hearth furnaces at some plants were underutilized.[47]

The second electric furnace, with an annual capacity of 250,000 tons of steel, at the Uzbek steelworks and the 100-ton electric unit at the Donetsk metallurgical plant were commissioned in 1978. Construction of the steel electric smelting shop at the Orsk-Khalilovo and West Siberian complexes began in 1978.

In 1979, crude steel production from 76 metallurgical works was below the planned quota of 156 million tons. The 1980 plan called for production of 157 million tons of crude steel. There were 42 oxygen converters (including 9 with a capacity of 250 to 300 tons) in operation in January 1980. Construction of the first continuous casting machine began in 1979. It will run 1 million tons of steel into billets ready for rolling. These will go to the large rolling mill, which has already been built. About 10,000 workers were engaged on construction at the Cherepovets complex in 1979.[48] Construction of a big oxygen converter shop at the Dzerzhinsk works in the Ukraine continued in 1979; the first stage was to be commissioned in 1980. Completion of the construction of the No. 4 oxygen converter at Nizhniy Tagil, in the Urals, was rescheduled for 1980. Renovation of No. 1 open hearth furnace at the Amurstal plant in Khabarovsk region started in May.

Development in the electric steelmaking

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sector continued. At the Azvostal' works in Zhdanov, a new electric smelting complex with two furnaces each of 250,000 tons capacity was built. This is the second section of the works. The Orsk-Khalilovo works began construction of an electric steel plant, and the first two 250,000-ton furnaces and a continuous casting machine were due to be in operation in 1980. Foundations have also been laid for an electric steel shop at the Kuznetsk works, where four furnaces are to produce 1 million tons per year of steel. A third electrical steel furnace of the same capacity is under construction at the Uzbek metallurgical complex in Bekabad.

Soviet finished rolled steel products output in 1979 was below the planned quota of 109 million tons. It was planned to produce over 109 million tons in 1980.

A rolling mill, with a capacity of 3 million tons per year of cold-rolled steel, is under construction at the Lipetsk metallurgical complex. The first stage of this mill, with a capacity of 1 million tons per year of steel sheet for the automobile industry, was rescheduled for 1980, owing to difficulties in obtaining materials. A rolling mill at the Moscow pipe works was put into operation in April 1979; this is the second mill supplied to this plant by a French firm. Completion of a rolling mill at the iron and steel complex in Beloretsk in the Urals was rescheduled for 1980. At the Zhdanov Il'ych metallurgical works in Donetsk Oblast' construction of a rolling mill, with a capacity of 2.5 million tons per year of sheet for gas trunklines, began in March 1979. At the Bekabad Lenin metallurgical complex in Uzbekistan, the building of a rolling mill began in October 1979. It will form part of an electric steel production complex being built there, where three of the five planned furnaces are in operation.

Renovation plans have been announced for Magnitogorsk. It is planned to replace the 10 existing blast furnaces by larger units, to build an oxygen converter shop, to go over to continuous steel casting, and mechanise all operations. Expansion and renovation of the West Siberian works were underway in 1979. All open hearth furnaces are being modernized and transferred to gas firing using gas from Tumen'.

The Oskol electrometallurgical complex, which will process ore from the Kursk Magnetic Anomaly, has become one of the major construction sites of the current 5-year plan period. This is the first enterprise in the country designed for the production of steel by direct iron reduction. It is being constructed by German firms; in December 1977, Soviet Metallurgimport awarded to Korf Stahl AG and Lurgi Chemie and Huettentechnik a DM500 million contract for four Midrex direct reduction units. A DM 185 million order for a pelletizing plant, with an annual capacity of 2.5 million tons, was awarded to Salzgitter.

In terms of tonnage, the Soviet Union was the largest world producer of steel pipe. The modernization of the 400-millimeter pipe-rolling mill was completed at the Rustavi metallurgical works in Georgia in May 1978. Several pipe manufacturers (Nikopol, Dneprovsk, Il'ich) and engineering works have been publicly criticised for delays in their deliveries to oil and gas industry enterprises. The gas industry has consumed about 4 million tons of steel pipe (including over 3 million tons of 530- to 1,420-millimeter pipe). Construction of facilities for pipe production continued at the Vyksa metallurgical plant in Gor'kiy Oblast'. Pipe developments in the U.S.S.R. include the construction of a new 15,700-ton-per-year pipe mill at the Azerbaydzhan plant and the 320,000-ton-per-year mill at the Severskiy plant in Sverdlovsk Oblast'. A ferroalloys furnace, with an annual capacity of 33,000 tons of ferrochromium, at the Chelyabinsk electrometallurgical complex was put into operation in November 1978. Installation of new equipment, with an annual capacity of 50,000 tons, at the Yermak ferroalloys plant in Kazakhstan began in June 1978. At the Yermak ferroalloys plant in Pavlodar Oblast' in Kazakhstan, the sixth and last electric furnace, with an annual capacity of 50,000 tons, started production in February 1979. This completes the construction of a complex with a production capacity of 300,000 tons per year.

During the 1976-80 period, it was planned to organize the production of 300 new, efficient hot-rolled shapes of steel, 250 cold-rolled shapes, and 20 high-precision shapes. The share of oxygen-converter steel in the total volume of smelting in 1980 was to increase to 34%, and production of steel by electroreduction was to increase to 19.5%. More than half of the capital investment for the development of ferrous metallurgy in the 10th 5-year plan period was assigned to the renovation and reequipment of existing units.

A £128.5 million agreement between the Soviet Union and Pakistan, which will provide more Soviet credits for a Karachi steel plant, was signed in July 1978. The initial designed annual capacity of the plant will be 1 million tons. The first blast furnace is to go into operation in the mid-1980's.

Lead and Zinc.—The Soviet lead and zinc industry is probably the second largest in the world. Estimated primary production in 1980 was 530,000 tons of lead and 775,000 tons of zinc. Reportedly, under the 1979-80 2-year contract, Cyprus Anvil Mining was to supply about 15,000 tons each of lead and zinc concentrates. The wholesale price of lead in the U.S.S.R. is from 530 to 675 rubles per ton.

During the 1966-77 period, output of zinc increased by 80%, but neither lead nor zinc output quotas were reached in 1979 nor in previous years, owing to the slow construction of new facilities and low metal recoveries.[49] Over 10% of the total lead and zinc production was recovered as a byproduct in 1979.

Over two-thirds of ore reserves are located in Kazakhstan, chiefly in the Altay region and in the district of Kara-Tau. There are also large reserves of zinc in the Urals. Exploration of the Uchkulach lead and zinc deposit in Uzbekistan, Chekmar' in Kazakhstan, and Kholodninskoye in Buryat A.S.S.R. continued in 1979. An exploration shaft was being sunk at the Achisay polymetallic complex in Kazakhstan.

Kazakhstan continues to be the leading lead and zinc producer, followed by the Urals, Uzbekistan, Siberia, North Caucasus, and the Ukraine. Production of zinc in Kazakhstan increased by 80% and that of lead by 32% during the 1967-76 period. It was planned to increase production of zinc in Kazakhstan by 8.8% in 1978 and that of lead by 3.1%. The planned quotas for lead and zinc production in Kazakhstan for the 1976-79 period were not met.[50] The planned increase in zinc and lead output for 1978-79 was based on increased production at the Leninogorsk, Zyryanov, and Tekeli complexes, as well as on the completion of the first stage of the Kargayly complex.

The Achisay complex in Kazakhstan, with its three main groups of mines, produced about 70,000 tons of lead, an unspecified quantity of silver, and an unknown quantity of barite in 1978. The Achisay ore contains from 1.5% to 2.0% lead, 13% to 15% barite, and 0.5 ounce of silver per ton.

In other mine and plant developments, the first stage of the Kargayly lead-zinc concentrator in Kazakhstan was completed in June 1978. It will supply raw material to the Chimkent lead plant and other plants. A lead section of the Solnechnyy tin concentrator in the Soviet Far East was commissioned in August 1978. In accordance with the plan for complex utilization of raw materials, a metallurgical plant is under construction at Solnechnyy. The complex is to be put into operation at the beginning of the 1981-85 5-year plan period, and its shops will extract blister lead and copper. Designing of the Ozernoye polymetallic mining and concentration complex in Buryat A.S.S.R. was completed in August 1978. A new shaft-smelting furnace was commissioned at the Chimkent lead plant in Kazakhstan in 1979. Because of ore shortages, production of concentrate at the Leninogorsk polymetallic complex decreased by 50% during the 1970-79 period.[51]

The future development of the ore base of the Altay region in East Kazakhstan is a serious concern to Soviet officials: The output of polymetallic ores has increased fourfold in the past 10 years, but grades have dropped by 40%. A 20% increase in the output of mined ore was reported at the Zyryanovsk complex with a 25% drop in lead-zinc content.

It is expected that the startup of the Nikolayevsk open pit will somewhat improve the situation, but that overall ore shortages will hold back lead and zinc production during the 11th 5-year plan period of 1981-85.[52] In order to compensate for the lack of incoming ore, the Ust'Kamenogorsk lead-zinc complex has begun to process large quantities of metallurgical wastes. Dust and slags from the Pyshminsk and Irtysh copper smelting plants, cakes and clinker from the Ust'Kamenogorsk zinc shop, and slags from old dumps have been treated in the smelting furnaces.[53]

In the Urals, the second largest zinc-producing region, the problem of zinc and gold recovery from the copper-pyrite ores remains unsolved. Slow development of the mines in the Urals has resulted in shortages at the concentrators. There are also shortages of lead-zinc reserves at the Sadonsk deposit in North Caucasus. This is the main supplier to the Elektrotsink zinc plant in Ordzhonikidze.

Magnesium.—Five magnesium plants, with an estimated combined annual capacity of 80,000 tons, were in operation in 1978-79. Production and consumption of rolled metal in the U.S.S.R. is small. Reportedly, over the years of the 9th 5-year plan (1971-75), the output of magnesium and its alloys increased 20%. According to the 1976-80 plan, output of magnesium and its alloys was to increase by 24% to 74,000 tons compared with an estimated 60,000 tons in 1975.

Manganese.—The Soviet manganese industry remains the largest in the world. About 80% of the total 1979 production came from the Nikopol' Basin in the Ukraine, and the rest from the Chiatura Basin in Georgia. Some 300,000 tons of crude ore were produced in Kazakhstan. During the 1976-80 period, new facilities for production of 6.4 million tons of crude ore were to be put into operation. Estimated production of marketable ore in 1980 was placed at 10 million tons. During the 1976-80 period, the greatest increase in manganese ore output was to be from open pit mining in the Ukraine.

About 20% of manganese exports were shipped to Western countries and some 80% to Comecon countries.

At yearend 1969, reserves of manganese ore in categories $A+B+C_1+C_2$ were estimated at 2.5 billion tons, with an average manganese content of 23% to 26.4%. This included 1,020 million tons in the Nikopol' Basin. Reserves of high-grade ore are located in the Chiatura Basin. Detailed exploration of the Ushkatyn III manganese deposit in Kazakhstan and preliminary examination of the Porozhin manganese deposit in Krasnoyarsk Kray continued in 1979.

The principal Soviet manganese basin, the Nikopol' in the Ukraine, has reserves many times greater than the Chiatura, but the ore (average grade 26.4% manganese) is little more than 2 meters thick and lies under some 80 meters of overburden. Two concerns, the Ordzhonikidze and Marganets, operate in the Nikopol' basin. There were 19 underground mines, 10 open pits, and 9 concentrators in operation in 1979. More than 75% of the ore mined there is from open pit operations. Of the concentrated ore, about 48% had a manganese content of over 45%; the balance contained 34%. The first stage of the new No. 9-10 mine at the Marganets mining concentration complex was put into operation in May 1978; development of the second stage of this mine continued in 1979. The first section of the No. 2 Grushevsk concentrator, with an annual capacity of 740,000 tons of concentrate, was commissioned in July 1978. Construction of the Tavricheskiy manganese complex in Zaporozhye Oblast' began in October 1979. Development of an underground mine at this complex, with an annual capacity of 2 million tons of crude ore, began in July 1979.

The Chiatura manganese basin in Georgia, the richest in the U.S.S.R., produced about 2.5 million tons of concentrates in 1979 from 24 underground mines and open pits and 8 concentrators. Over 80% was extracted from underground mines. Of the total beneficiated ore, 66% of the concentrate contained 48.7% manganese and the rest 25.6% manganese. New mining facilities, with an annual capacity of 350,000 tons of crude ore, began operation at the Chiatura basin in January 1978. The third section of the Akhali Itkhvisi mine in this basin, with an annual capacity of 130,000 tons of crude ore, was put into operation in October 1978. Development of two small mines continued in 1979. They were to be commissioned in 1980.

Small amounts of manganese ore were produced at the Dzezhdy and Atasuy mines in Kazakhstan. The Dzezhdy manganese ore-dressing plant, which was put into operation in May 1965, processed low-grade ore for the Nikopol' (Ukraine) and Yermak (Kazakhstan) ferroalloys plants. Kazakhstan's manganese ore is sulfur-free and does not contain other impurities. The small Zhaksykotyr manganese open pit became operational in 1978. Development of the Tsentral'naya mine of the Dzhedy Ore Administration continued.

Mercury.—In 1978-79, the U.S.S.R. was the world's largest producer of mercury and was apparently self-sufficient. There are numerous deposits mainly in Central Asia, the Soviet Far East, and the Ukraine. The Khaydarkan complex in the south of Kirgiziya, the largest Soviet mercury operation, had four mines and a recovery plant in operation in 1979. At this complex, mercury is mined by both underground and open pit methods. Sinking of the 850-meter Tsentralnaya shaft of the Ulug-Too mine at this complex continued in 1979. A new shaft at the Chanvay mine of the Khaydarkan complex was under development in 1978-79. It is planned to develop the Novoye mercury-antimony deposit at the Khaydarkan complex. The renovation of metallurgical facilities at the Khaydarkan complex continued in 1979 and was scheduled for completion in 1980.

The Nikitovskiy complex in the Ukraine, where over 70% of ore is mined by underground and about 30% by open pit methods, is the second major producer of mercury. Two underground mines (2-bis Novaya and Novozavodskaya) and the Polukupol Novyy open pit were in operation here in 1978-79. The small Zakarpatskiy mercury complex processes ores from the Borkutnoye, Shayanskoye, and other small deposits in Zakarpatskaya Oblast', West Ukraine.

Mercury output in Magadan Oblast' was higher in 1979 than in 1978. Construction of the new Dzidzikrutskiy (Aznob) mercury-antimony complex in Tadzhik S.S.R. continued during the year. Completion of the first stage of this complex had been rescheduled for 1980 from 1976. The development of small deposits is planned in North Caucasus, at Chukotka in Magadan Oblast', and in other regions of the U.S.S.R. Exploration for new deposits in Kirgizia, the Soviet Far East, and other regions of the country continued in 1979.

Molybdenum.—About 50% of the production is based on copper-molybdenum ores from Armenia, Kazakhstan, Sorskoye, and Siberia; over 30% is from the tungsten-molybdenum ores of Tyrny-Auz (Kabardin A.S.S.R. in the North Caucasus) and Dzhida (Buryat A.S.S.R.). The remainder arises from molybdenite ore mined in Uzbekistan and Siberia. There are more than 100 known deposits of molybdenum, mainly in the Urals, but most are too small to be economically mined.

The deposits now in exploitation are in eight geographical areas. Armenia occupies first place, but concentrates are shipped out of the Republic for further treatment. The Zangezur copper-molybdenum complex (the former Kadzharan and Kafan complexes) supplied over 25% of Soviet molybdenum in 1979. Open pit mining and high metal content in the ores have made Kadzharan molybdenum concentrate among the cheapest in the U.S.S.R. However, there are shortages of ore reserves at the Kafan and Agarak mining and concentration complexes. A drying shop for molybdenum concentrate at the Zangezur complex was put into operation in August 1979. It is planned to install a molybdenum converter at the Alverdy metallurgical complex in Armenia.

The Sorsk molybdenum complex in Krasnoyarsk Kray in Eastern Siberia became one of the leading individual molybdenum enterprises of the U.S.S.R. in 1978. Renovation of the 29-year-old Sorsk complex, which began in 1973, continued in 1978-79. The slow increase of the production capacities of this complex has been mentioned in several Soviet published sources. The molybdenum concentrators of the Balkhash metallurgical complex in Kazakhstan and Dzhida tungsten and molybdenum complex in Buryat A.S.S.R. increased output of molybdenum concentrate in 1978. The Chorukhdayron deposit in Tadzhikistan has been almost completely depleted. Currently the Yuzhno-Yangikan copper molybdenum and the Yubileynyy tungsten deposits, both discovered in the 1960's are being mined.

The Tyrny-Auz tungsten-molybdenum complex, which operates the Molibden underground mine and the Mukulanskiy open pit, was undergoing enlargement in 1979. Output of ore at the Mukulanskiy open pit increased. The Chorukhdayransk concentrator processes copper-molybdenum ores from the Chorukhdayransk and South-Yashransk deposits in Tadzhistan. Output of rolled molybdenum in Uzbekistan increased in 1979. Construction of the Zhireken molybdenum complex in Chita Oblast', the completion of which was originally planned for 1975, lagged behind schedule in 1979.

The first stage of the Erdenet copper-molybdenum mining and concentration complex in Mongolia was completed in 1979. Exploration in the 1960's outlined large ore reserves grading 1% copper and 0.02% molybdenum. The concentrates from this complex are shipped to the U.S.S.R.

Nickel.—In 1978-79, Soviet nickel output was second to Canada. During the 1966-75 period, output of nickel increased by 94%. There is a plan to increase metal production by 20% to 30% in 1980 compared with that of 1975. Production was estimated at a probable 155,000 tons in 1980. About half of known reserves consists of low-grade silicate ores. Over 50% of the total reserves is in cupriferous pentlandites, containing commercially recoverable copper, cobalt, platinum-group metals, and some minor metals. Sulfide ores are mined at Norilsk in Krasnoyarsk Kray (East Siberia) and in the Pechenga-Monchegorsk area in the Kola Peninsula. Oxide ores are produced in the Aktyubinsk area of Southern Urals, the Ufaley area of the Central Urals, and the Ukraine. The centers of production, in order of importance, continued to be Norilsk, Urals, and the Kola Peninsula. Of the seven smelters in operation, Norilsk is the most important; Ufaley, Rezh, and Khalilovo smelters in the Urals are a close second; Monchegorsk and Pechenga smelters are third; and the Pobuzhsk ferronickel plant in the Ukraine is fourth. About 20,000 tons of nickel cobalt concentrate from Cuba is smelted in the U.S.S.R. In the future, the Soviet Union will be an important nickel exporter based on both Soviet and Cuban concentrates.

The Norilsk complex in East Siberia is

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producing copper, nickel, cobalt, platinum group metals, gold, silver selenium, and other rare metals. During the 3-year period prior to 1979, production of refined nickel increased by 10.9% compared with a 20% planned target. It is planned to construct the first stages of the No. 2 concentrator and Nadezhda smelter by the end of 1980 and to develop additional mining facilities. The new facilities are to increase capacities for production of nickel by 80%, copper by 70%, and cobalt by 160%. Prospecting is being carried out north of Norilsk.

One open pit (Medvezhiy Ruchey) and one underground mine (Zapolyarnyy) operate the Norilsk I deposit. Two underground mines (Mayak and Komsomol'skiy) operate Talnakh deposit. Four stages of the Oktyabr' underground mine are in operation and a fifth stage is under development. The Oktyabr' mine, the larget underground mine in the nonferrous sector, was to produce about 50% of the total ores at Norilsk in 1980. Sinking of the 1,428-meter ventilation shaft at the Taymyrskiy mine was continued in 1979. The first stage of the Taymyrskiy mine is due to be commissioned at the end of 1981. Prospecting is being carried out north of Norilsk by 30 exploration teams, comprising 270 persons.[34]

During the 1976-77 period, two electric furnaces went into operation after renovation at Norilsk. The capacities increased by 11% to 17%. The third and fourth furnaces at this complex were to be renovated in the 1978-79 years. Construction of the 1,000-million-ruble Nadezhda metallurgical complex at Norilsk, a major project of the 10th 5-year plan (1976-80), continued with the technical assistance of Finnish companies. The capacity is to be 550,000 tons per year of nickel concentrate (100,000 tons of nickel). The autoclaves to be used here are the first in the Soviet Union's nonferrous metallurgy. The first section was put into operation in October. When the Nadezhda complex attains full capacity, it is expected that output of nickel will be doubled. The new facility will be fed by a 32-kilometer slurry line from Talnakh.

The ores at the Severonikel complex at Monchegorsk are mined by both open pit and underground methods. The Zhdanov complex is the largest in this area. Four small underground mines (Kaula, Kotselvaara, Kammikivi, and Northern) and two small open pits (Kaula and Kammikivi) were in operation at the Pechenganikel complex. The port of Murmansk continued handling Norilsk ore for the Severonikel complex. During the 7 to 8 months of the navigation season, some 200,000 tons were shipped; this figure is to be increased in the future. Oxide ore is mined at Promezhutochnoye, Novo-Burenov, Oktyabr', and other deposits. The Scherbakov oxide-ore open pit at the Kempersay region in the Aktyubinsk area of the south Urals in Kazakhstan was put into operation in January 1979.

The U.S.S.R. is financing a $600 million expansion of Cuban nickel production, with output of 20,000 tons per year scheduled for 1985. It was planned to expand production of the Nicaro plant from 18,000 to 22,500 tons per year by 1980, to expand production of nickel at the Moa plant from 18,000 to 24,000 tons per year by 1980, and to construct two 30,000-ton-per-year nickel cobalt oxide plants within 8 kilometers of the Moa plant. The first new plant (Punta Gorda) is scheduled for completion by 1983-84, and the target for the second is 1985-86.

Platinum.—The Soviet Union remains the largest producer and exporter of platinum-group metals, supplying 20% to 25% of international exports of platinum and more than 50% of world consumption of palladium and rhodium. The U.S.S.R. is steadily expanding its output of platinum-group metals. Ore reserves are adequate to maintain production and increased exports for many years. In 1975, it was planned to increase production of platinum-group metals at Norilsk by 60% over 1970 levels. The 5-year plan called for Norilsk output to rise by about 80% in 1980 over that of 1975. But slow construction of the Nadezhda plant has limited Soviet primary production increases to an annual rate of 4% to 5%. Production of platinum and platinum group metals may reach 3.3 million ounces in 1980.

Production of platinum and platinum-group metals comes principally from the Norilsk copper and nickel complex in Krasnoyarksk Kray, the Severonikel and Pechenganikel complexes ("Nikel" association) on the Kola Peninsula, and several small placer deposits in the Urals. Virtually all platinum-group metals were produced as byproducts with over 75% coming from Norilsk. The first section of the Nadezhda plant at the Norilsk complex was put into operation in October. The high priority given to the Norilsk development suggests a determination to proceed with increased production despite high cost imposed by the harsh northern climate. Expansion is expected to accelerate in a few years, with completion of the Oktyabr' underground mine and the No. 2 concentrator, and the attainment of capacity of the first stage of the Nadezhda smelter. The mine, under development since 1969, was scheduled for completion in six stages by 1980; the first four were in operation, and development of stages 5 and 6 was in progress in 1979.

The first of five platinum coins in the 1980 Moscow Olympic series, a 150-ruble piece, was distributed in the United States and Western Europe in November 1978. The coin contains 15.55 grams of almost pure platinum and sells at a suggested retail price of $390. Reportedly, production of the coins is limited to a total of 40,000 with an additional 10,000 reserved for distribution in the U.S.S.R. and other centrally planned economy countries. During the first 9 months of 1978, the United States imported from the Soviet Union platinum-group metals at a value of $25.1 million, including palladium worth $18.6 million, rhodium worth $4 million, and platinum worth $2.5 million.

Silver.—Almost all silver is produced as a byproduct from nonferrous operations although 14 gold treatment plants also produced silver in 1978-79. The Norilsk complex in Krasnoyarsk Kray and some copper-nickel enterprises in the Kola Peninsula are also producing silver. Production continued to be centered in the Urals, Kazakhstan, the Soviet Far East, East Siberia, and Armenia. The recovery of silver at benefication plants in the Urals ranges from 15% to 50% from complex ores containing 6 to 15 grams per ton of silver. The silver content in Soviet lead concentrates fluctuates from 680 to 860 grams per ton.

The ash of burned Soviet film contains almost 0.2% grams of silver per kilogram. The Riga secondary precious metals plant increased production of secondary silver again in 1979, having done so several times in the 1970-79 period. The Moscow plant for secondary production of precious metals is the main producer of secondary silver. The L'vov Electron Production Association collected 227 kilograms of secondary silver in 1979.

Tin.—Although the Soviet tin production policy is based on self-sufficiency at any price, output continues to be inadequate and about 20% of requirements had to be imported in 1979. The Soviet Far East, Yakutia, and Transbaykal were the main tin producers. The estimated output of tin may reach 35,000 tons by 1980. Most new production will come from existing or currently developing mines in the Soviet Far East and Central Asia. In 1979, over 25% of total output was from placers, of which the Soviet Northeast accounted for 75%.

There are shortages of explored tin reserves at many enterprises. The average content in ores ranges from 0.6% to 1% Sn. Intensive exploration programs have been carried out, and new small deposits have been reported. The reserves of the Uchkoshon deposit were confirmed in 1978.

The Maritime Kray is the largest producer, and the Khrustal'nyy complex, which operates both lode and placer deposits, is the largest enterprise there. This complex operated the Khrustal'nyy, Ege-Khaya, Imeni Lazo, Kholodnyy, and Alyakavityy mines in 1979. The Ternistyy and Arsen'evskaya mines of this complex, which were scheduled for completion in 1975, were under development in 1979 and had been rescheduled for completion by 1980. The ore grade is 0.18% to 0.91% Sn at the Arsen'evskaya mine and 0.87% at the Valkumey mine in Magadan Oblast'.

The Khingan complex at Birobidzhan, Jewish Autonomous Oblast', Khabarovsk Kray, the largest tin-producing enterprise in the U.S.S.R., was to produce 12% more tin concentrate in 1979 following renovation of the concentrator. Development of the Berezovyy mine at this complex continued. The Solnechnyy complex operated the Solnechnyy, Molodezhnyy, and Pereval'nyy mines. Expansion of the Solnechnyy complex at Khaborovsk Kray, Sherlovgor in the Transbaykal area, and the Deputatskiy complex in the Yakut A.S.S.R. continued in 1979. The Tagobikul, Kumarkh, Mushiston, and Kaznor deposits of Tadzhikistan are producing small quantities of tin. Ores from both the Svetlyy and Tultin mines are processed at the Iultin complex in Magadan Oblast'.

Three known tin refineries were operating in the U.S.S.R. in 1978-79: Novosibirsk, Ryazan', and Podol'sk (near Moscow). Concentrates from Siberia and the Soviet Far East are shipped to the Novosibirsk plant, which is the principal supplier of tin in the U.S.S.R. It was planned to increase output of metal at the Sherlova Gora, Ege-Khaya, Leningrad, Sinancha, and other smelters. Construction of a tin-processing unit at the Rustavi secondary nonferrous metals plant in Georgia continued in 1979. Reportedly, the Soviet built volatilization plant at Palca near Potosi in Bolivia was completed in 1978. The project for a similar facility at Machacamarca is at the feasibility study

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stage. Each of these complexes will handle some 400 tons of ore daily, producing 2,400 tons of tin annually.

Titanium.—Production of titanium was programed to be raised 40% in the 1976-80 period. Estimated output for 1980 was 41,000 tons. Soviet reserves of ore are averaging 10% to 20% TiO_2. The industry continued to be based mainly on Ukrainian and Siberian ilmentite and rutile.

The Soviet Union, which was supplying about 35,000 tons per year of titanium sponge to the world market, curtailed shipments in 1979. As a result, prices jumped from under $10 per kilogram to about $40. Reportedly, the U.S.S.R. imported 44,000 tons of titanium ores (ilmenite, rutile, and zircon) from Australia in 1979.

The most important sources of ilmenite are placer deposits on two right-bank tributaries of the Dnieper River in the Ukraine. Major producers continue to be the Samotkanskoye zirconium-titanium alluvial deposit and the Volchanskoye titanium deposit in Dnepropetrovsk Oblast'; the Irshanskoye, Streminogorskoye, and Zelenogorskoye titanium deposits in Zhitomirskaya Oblast'; and the Tarasovskoye deposit in Kiyevskaya Oblast'.

Two complexes, the Irshanskiy using dredges and the Verkhnednepprovskiy, operate these deposits and are the main raw material suppliers for the Soviet titanium industry. Four stages of the Irshansk concentrator were in operation in 1979.

The output of titanium sponge in Kazakhstan was increased by 125% in the 1966-76 period and by 41% over the years of the ninth 5-year plan (1971-75). Output of titanium sponge at this complex was planned to be raised by 7.7% in 1978 over the 1977 level, but later adjusted to 5.6%.

Tungsten.—North Caucasus, Kazakhstan, Uzbekistan, Transbaykal, and the Soviet Far East continued to be the principal producers. Production of tungsten was insufficient to satisfy growing domestic needs, and about one-third of the concentrate requirements were imported. The following deposits were under exploitation in 1979: Tyrny-Aug (North Caucasus), Dzhida (Buryat A.S.S.R.), Chorukh-Dayron, Lyangar, Yubileynoye, and Ingechka (Central Asia), Akchataus, Karaobin, and Verkhne-Kayraktin (Kazakhstan), Iultin (Magadan Oblast'), Vostok and Lermontov (Maritime Territory), and Kul'gutin in Altay region. Most of the deposits in the U.S.S.R. are low grade. Production is estimated at 8,900 tons in 1980. The large deposit in the North Caucasus, the Tyrny-Auz deposit, contains both molybdenum and tungsten. The largest deposits in Kazakhstan are the Verkhne-Kayraktin tungsten and Akchatau molybdenum-tungsten deposits. There are considerable reserves of tungsten at the Ingechke deposit in Uzbekistan and the Jidda deposit in Siberia.

The main producer of tungsten concentrates is the Tyrny-Auz tungsten and molybdenum complex, where both underground and surface methods are used. The Nal'chik plant, based on Tyrny-Auz concentrates, continued operations with the expected increase in tungsten metal output. The Iultin complex is the only tungsten mining enterprise in Magadan Oblast', and extensive improvements are being carried out here. The Chorukh-Dayronsk deposit in Tadzhikistan is almost completely depleted and has been replaced by the Yubileyonye deposit, which was put into operation recently. The exploration of the Bogutin deposit in South Kazakhstan and the Maykhura deposit in Tadzhikistan was completed.

The second stage of the Martime Kray complex was under construction and scheduled for completion in 1982. Originally the richest tungsten ores were mined by surface methods, but an underground mine is now under development.

Vanadium.—The Soviet Union, with large vanadium resources, is becoming an important producer and exporter. The principal sources in 1978-79 continued to be vanadium-rich slag, a co-product with iron from the titaniferous magnetites of the Kachkanar open pits in the Urals. The Nizhniy Tagil metallurgical complex and the Chusovskoy metallurgical plant in the Urals are the enterprises that produce raw material for the production of vanadium and its alloys. Nizhniy Tagil, where the vanadium slag is produced from 130-ton oxygen converters, is the only modern enterprise. The vanadium content of the pig iron at Chusoyoy is 0.54%, and that at Nizhniy Tagil is 0.45%. After devanadisation of the pig iron, the average V_2O_5 content of the slag at Chusovoy is 17.2% and that at Nizhniy Tagil is 21.2%.

The enlargement of facilities at the Kachkanar complex, from 33 million tons of crude ore to 40 million tons, and the processing of vanadium at the Nizhniy Tagil metallurgical complex has made it possible to increase the output of vanadium products considerably. It is planned to develop the Kachkanar No. 2 and to increase production of vanadium in the future. It is also planned to construct special units at some alumina plants for the recovery of vanadium pentoxide as a byproduct from bauxite and other raw materials.

Minor Metals.—The Soviet Union possesses commercial deposits of all the rare metals that have assumed importance in modern rocketry, aircraft, and nuclear energy. However, extraction of many of them remains low. The main deposits are in Kazakhstan, Kola Peninsula, Uzbekistan, Armenia, Urals, Ukraine, Norilsk, Transbaykal, and the Soviet Far East. Known resources of rare metals were sufficient to satisfy the needs of the 1976-80 5-year plan, but prospecting still lagged behind the potential of the main producing regions of the Soviet Union.

The primary sources of rhenium are molybdenite from copper-molybdenum deposits of Armenia, Kazakhstan, and East Siberia. Byproduct rhenium is recovered at the Balkhash and Dzezkazgan complexes in Kazakhstan, at the Kadzharan copper-molybdenum complex in Armenia, at the hard-alloy plant in Uzbekistan, and at some other plants.

The selenium content in the copper-molybdenum ores of Armenia ranges from 3.6 to 10.5 grams per ton and that of tellurium from 1.5 to 6.2 grams per ton. Copper concentrates of Armenia contain 46 to 110 grams per ton selenium and 18 to 62 grams per ton tellurium. There are 110 grams of selenium and 40 grams of tellurium in the charge of the Alaverdy metallurgical complex in Armenia. Extraction of both metals increased there in 1979.

Production of gallium increased at the Chimkent lead plant in Kazakhstan in 1979. Byproduct gallium is recovered from raw materials used to produce aluminum at Volkhov (Leningrad Oblast') and Pavlodar (Kazakhstan) aluminum plants and at the Tikhvin (Leningrad Oblast') alumina plant. The main centers of indium and thallium extraction continued to be the Ust'Kamenogorsk lead and zinc complex (Kazakhstan) and the Chelyabinsk zinc plant. The Ust'-Kamenogorsk titanium and magnesium complex in Kazakhstan began recovering scandium.

During the 1965-75 decade, the production of rhenium began at the Balkhash and Dzhezkazgan complexes and the Chimkent lead plant in Kazakhstan, as well as gallium at the Pavlodar aluminum plant, and vanadium and scandium at the Ust'-Kamenogorsk titanium and magnesium complex. At the Chimkent lead plant, facilities for production of thallium, cadmium, tellurium, germanium, and other minor metals from slag have been put into operation.

Zircon alluvial deposits exploited in 1978-79 included the Samotkan deposit in Dneprovsk Oblast' in the Ukraine. The Verkhnedneprovskiy complex, brought into operation in 1969, increased output of zircon concentrate in 1979. The Mekhanobr Institute in Leningrad has developed technology for recovery of baddeleyite (ZrO_2) from magnetite iron ore of the Kovdor deposit at the Kola Peninsula.

The Soviets claim the world's largest deposits of columbium and tantalum within the limits of the Lovozero massif in the Kola Peninsula. There were two underground mines, the Karnasurt and Umbozero, in operation at Lovozero in 1979. Smaller columbium-tantalum-bearing deposits are found in the Urals, Ukraine, Caucasus, and Transbaykal. The Soviet ilmenite concentrates contain at the average 0.12% Cb_2O_5 and 0.008% Ta_2O_5.

NONMETALS

The Soviet Union produces a wide variety of nonmetallic minerals. However, the resource position varies from an adequacy for many nonmetallic minerals to an apparent shortage of others such as barite, fluorspar, mica, and talc.

Bentonite.—Armenia, Tadzhikistan, and Kazakhstan remained the three principal centers of bentonite production. The Isfara plant in Tadzhikistan, which supplies ground clay for oil well drilling, was renovated, and output is expected to increase more than twofold. New bentonite deposits were found in the Ishdevan mountains in Armenia, and new facilities for production of 130,000 tons of bentonite clay at the Izhdevan complex were put into operation in 1978. Construction of the Barsa-Gelmes clay works in Turkmenistan continued in 1979.

Asbestos.—For the fifth consecutive year, the Soviet Union has maintained its lead over Canada as the largest world producer of asbestos. Over 62% of the total production came from the Uralasbest complex, about 26% from Dzhetygara in Kazakhstan, 10.5% from Tuvaasbest complex in Tuva A.S.S.R., and 1.2% from Kiembay complex in Orenburg Oblast'.

During the 1971-77 period, new facilities with an annual capacity of 1 million tons of asbestos were put into operation. In addi-

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tion, as a result of renovation, capacity increased by 204,000 tons. Because of the asbestos export expansion in recent years, there was a domestic deficit of about 100,000 tons in 1979. Estimated output for 1980 was 2.6 million tons.

Development in the asbestos industry has been concentrated in the Urals, Kazakhstan, Tuva A.S.S.R., and Orenburg Oblast'. Total output of the seven grades of asbestos at the Uralsasbest complex was estimated at 1.54 million tons. Three open pits at this complex produced 41 million tons of crude ore and dumped 103 million tons of overburden in 1979. It was estimated that mining of crude ore and overburden would be increased from 144 million tons in 1979 to about 150 million tons in 1980, but production of marketable asbestos was expected to remain unchanged at about 1.5 million tons because of reduced grades.

In Kazakhstan, a large complex has been developed for the Dzhetygara deposit in Kustanay Oblast', the second largest in the Soviet Union. The first mill (annual capacity 200,000 tons) was commissioned in 1965. During the 1971-75 period this mill was renovated, and production increased from 259,000 tons in 1970 to an estimated 350,000 tons in 1979. The Dzetygara No. 2 mill (annual capacity 400,000 tons) was completed in 1975 and produced an estimated 290,000 tons in 1979. Total output at the Dzhetygara complex was to fall from 645,000 tons in 1978 to an estimated 640,000 tons in 1980.

The first mill of the Tuvaasbest complex (commissioned in 1964) produced over 60,000 tons in 1979. A second mill was commissioned in April 1976, and estimated production was 200,000 tons in 1979. Total output at this complex was to be increased from an estimated 250,000 tons in 1978 to a planned 265,000 tons in 1980.

Construction of the Kiembay asbestos complex in Orenburg Oblast' (Southern Urals) was started in 1968 and continued in 1979. Seven Comecon members are assisting with this project. It calls for a total contribution of 106.2 million transferable rubles from the six East European member countries. The total cost of the project is 300 million rubles.

The design capacity of the Kiembay project is 500,000 tons per year of grade III through VI from 24 million tons of ore. The first 250,000-ton stage was completed in November 1979, and some 30,000 tons were produced. The output will be shared among the Comecon members in proportion to their contribution. Equipment was supplied by Bulgaria, Hungary, the German Democratic Republic, Poland, and Romania; Czechoslovakia shipped machinery for ore transport. From 1980, some 170,000 tons of asbestos will be supplied annually to the participating countries for 12 years, and afterwards they will be able to extend the agreement for another 10 years.

Prospecting of the Moladezhnoye asbestos deposit in North Buryatia was completed in 1979. Reportedly, it contains about 18 million tons of asbestos and will be mined by surface methods. The original design was completed in 1974, and construction will be started when the western section of the Baykal-Amur railway is built. Exploration of the Sayan asbestos deposit on the border of Krasnoyarsk Kray and Tuva A.S.S.R. in East Siberia was completed, and reserves are estimated at 7 million tons of asbestos. The Lenin complex, with an annual capacity of 200,000 tons, is to be built there. The asbestos lies at a comparatively shallow depth and will be mined by the open pit method. An experimental pit was set up at this complex in 1979. When the complex is put into operation, it will reduce the U.S.S.R.'s asbestos shortage.

Barite.—Barite is mined by both open pit and underground methods at many operations; crude output is concentrated by flotation. About 50% of the country's barite consumption in 1979 was produced domestically; the balance was imported mainly from North Korea, Yugoslavia, and Bulgaria. The main centers of production continue to be Georgia, West Siberia, and Kazakhstan. Construction of a 45,000-ton-per-year complex in Khaishi in Svanetia, Georgia, and the development of the underground mine at the Zharemsk polymetallic complex in Kazakhstan continued in 1979. Production of barite was estimated at 525,000 tons in 1980.

Diamonds.—The U.S.S.R. continues to make progress in expanding its diamond industry, which is centered in Yakutia, where about 20 deposits have been discovered. Production of diamonds was estimated at a probable 11 million carats in 1980. Next to fossil fuels and precious metal exports, diamonds account for a large share of the Soviet Union's overall foreign currency earnings.

Production in Yakut A.S.S.R. started at a small plant in 1957. In January 1979, the industry consisted of the Mirnyy open pit with five concentrators, the Aykhal open pit and concentrator, the Udachnaya placer mine and concentrator, and the Irelyakh placer mine with two dredges. Small quantities of gem and industrial stones are produced from the Vishera River Region in Perm Oblast' (western Urals) where four dredges and two seperation plants were operated at two deposits in 1979. The enlargement of the Udachnyy complex was completed, and the second stage of the concentrator was put into operation in August 1978. A fleet of about 40 75-ton Bel AZ 549 dump trucks are in use at the Udachnaya open pit for ore and overburden. This pit is the second mining enterprise (after the Mirnyy open pit) in the country where these trucks are used. The town of Udachnyy is being built at the diamond deposit at the edge of the Polar Circle.

The principal task of Yakutia's special geological expedition in 1979 was to discover new diamond deposits for which more funds were allocated. The amount of drilling was to be increased from the 1978 total of 110,000 meters to 150,000 meters in 1979. Work was to be concentrated on the most promising areas in the central and northern part of the Yakut A.S.S.R.

Output is about 80% industrial stones and 20% gems. Gem stones are cut at Leningrad, Sverdlovsk, and Smolensk. Sales of cut stones are rising steadily, and substantial increases are expected by 1980. The U.S.S.R. has arranged to market part of its diamond output in Antwerp through a newly formed Soviet-Belgian company in which the Soviet export organization, Almazyuvelirexport, has the controlling interest.

A substantial but unknown quantity of synthetic diamond was produced in 1979 by plants in Kiyev, Yerevan, Moscow, Tashkent, and Poltava.

Nitrogen.—Ammonia production was to benefit from imported technology. Some 26 large ammonia plants were planned to be commissioned in 1976-80, representing 11.4 million tons of the 13.5 million in planned additional capacity. The results achieved by 1979, however, did not appear to justify the goals set in 1976. During the 1976-80 period, equipment for 26 ammonia plants, each with a capacity of 450,000 tons, was to be supplied by Western companies. All these plants will be constructed with the assistance of Toyo and Mitsui Engineering (18 plants), Chemico (4 plants), and Cruesot-Loire (4 plants). Of 14 ammonia plants scheduled for completion in 1978, only one plant, in Togliatti, was commissioned on December 31, 1978. Eight were completed in 1979: Berezniki No. 2, Gorlovka No. 2, Kemerovo No. 2, Cherepovets, Dneprodzerzhinsk, Cherkassy, Odessa No. 2, and Togliatti No. 3. Additional facilities at Sumgait were commissioned, bringing the total capacity to 1.2 million tons per year. Two ammonia plants near Odessa (Odessa Nos. 1 and 2) have been built on a compensation basis under an agreement with Occidental. They will supply urea to the United States in exchange for superphosphate acid.

Phosphate.—The main producing centers continued to be the Apatite Association on the Kola Peninsula and phosphorite deposits at Karatau in Kazakhstan. The Chilisay phosphorite basin in Aktyubinsk Oblast', Kazakhstan, which is under development, will be the third main center of phosphorite production. Deposits of phosphorites also occur in Upper Kama in the Urals, Egor'evsk and Lopatino in Moscow Oblast', Kingisepp in Leningrad Oblast', and some other regions, but the grade is rather low. Generally they produce phosphorite flour with about 19% P_2O_5. The apatite concentrate provided over 80% of all raw materials for the production of phosphate fertilizers. Production in 1980 was estimated at 46 million tons of apatite ore (17 million tons of concentrate) and 19 million tons of sedimentary rock. Over a number of years, the Soviet Union has been progressively reducing its exports of apatite concentrate to Western Europe.

The Khibiny apatite-nepheline deposits are the largest single phosphate source. Mined ore averaging 16.3% is upgraded to 39.4% P_2O_5. The Apatite complex produced an estimated 16.3 million tons of concentrate (44.7 million tons of ore) in 1979 from the following mines: Kirovskiy, Yuksporskiy, Rasvumchorskiy, and Tsentral'nyy. The concentration is by flotation in two plants. Plant No. 2, with an annual capacity of 11.5 million tons of concentrate (30 million tons of ore), is under enlargement. New facilities, with a yearly capacity of 4 million tons of ore and 1.3 million tons of concentrate, were commissioned at the Apatite complex in 1978. Exploration of the Partomchor apatite-nephiline deposit in the Khibiny Mountains was completed in 1978. It is planned to produce 17 million tons of apatite concentrate (46 million tons of ore) in 1980. By 1990, production of concentrate is to reach 22 million tons from 60 million tons of ore.

A new apatite deposit at Mount Koashva was assigned to the Apatite Association in 1973. The Koashva (Vostochnyy) open pit, with an annual capacity of 7 million tons of ore, was under development in 1979. The first stage of this open pit was rescheduled for completion in 1980 and will be linked to Kirovsk by rail. Detailed exploration of the Nyorpakhsk apatite deposit was completed in 1979, and development was to start in 1980. It will be the sixth mine of the Kola Apatite Association.

At the Kovdor iron ore complex of the Kola Peninsula an apatite concentrate plant with a first-stage capacity of 880,000 tons was commissioned in 1975; the second stage was under construction in 1979. It processes tailings from the iron ore concentration complex. Construction of flotation plant No. 3 at the Apatite Association began in 1979, and the first stage, with an annual capacity of 3 million tons of apatite concentrate, is to be completed by 1985. Preliminary surveys of the Seligdar apatite deposit in South Yakutia were completed in 1979.

There are 45 commercial deposits at the Karatau phosphate basin in Kazakhstan. The five largest contain more than half of the total reserves of Karatau. Seven open pits at the Aksau and Zhantas deposits and the Molodezhnyy underground mine at the Chulaktau deposit produced an estimated total of about 10 million tons in 1979. Surface mining of the Aksay deposit terminated, and sinking of the shaft began in 1978. Development of the Tyesay deposit for surface mining continued in 1979. Approximately 1 billion rubles was to be spent on increasing Karatau's production during the 1976-80 period. It was planned to increase capacity from existing and new mines by about 20 million tons per year of phosphate ore and 13 million tons per year of concentrate by the end of 1980. Three new mines (Kokdzhan, Tyesay, and Koksu) were to start production, and the Zhantas mine was to be enlarged. The second stage of the Novo-Dzhambulskiy phosphate plant was commissioned in 1979. It was planned to produce 9.6 million tons of concentrate and 4.1 million tons of phosphate flour at Karatau in 1980. During 1977-80, the following mines were to be commissioned: Kok-Dzon (annual capacity 4.75 million tons of ore), Tyesay (capacity 2 million tons), Kok-Su, Ur-Bas, Ceres, Kis-Tas, and other small mines with a total capacity of 20 million tons of ore and 13 million tons of marketable products.

Development of the Chilisay open pit in Aktyubinsk Oblast', Kazakhstan, began in 1978. It was planned to mine 5.9 million tons of ore and to produce 1.77 million tons of phosphorite flour from this deposit in 1980. Construction of the Chilisay complex continued in 1979. The Voskresensk complex in Moscow Oblast' produced over 2 million tons of phosphate flour in 1979. Production of ground phosphate rock at the Verkhnekansk phosphorite area reached about 0.6 million tons in 1979 and was to reach 0.7 million tons in 1980.

The phosphate reserves in place at the Karatau basin in categories $A+B+C_1$ were estimated in 1978 at about 1.5 billion tons and 500 million tons in category C_2 (overall average grade 21% to 26% P_2O_5). The reserves in place of the Chilisay phosphorite basin were estimated at over 1 billion tons in categories $A+B+C_1$ and about 800 million tons in category C_2.

An agreement on development of a new phosphate mine and auxiliary facilities at Meskala, Morocco, has been reached between Morocco and the U.S.S.R. The contract calls for the Soviets to provide about $2,000 million for development of the mine and construction of a railway linking it to a new harbor to be built on the Atlantic coast. The Soviets will build and equip the mine, which is scheduled to come into production in the mid-1980's at a capacity of 2 million tons per year and to increase to 10 million tons per year by the early 1990's. The capital investment is to be repaid by shipment of phosphate rock, triple-superphosphate, and phosphoric acid to the U.S.S.R. Reportedly, Jordan has asked the Soviet Union to aid the development of a phosphate deposit at Aqaba in return for repayment in long-term supplies of phosphate rock.

Potassium.—The Soviet Union is one of the world's leading countries in potassium ore reserves, production, and exorts of potash salts. Under the 1976-80 plan, output of potash was to increase 35% from 19.1 million tons (41.6% K_2O) in 1975 to 26 million tons in 1980. It was planned to complete construction of Soligorsk No. 4, Berezniki No. 4, and Novosolikamsk No. 1 by 1980. It was also planned to enlarge Solikamsk No. 1 and Soligorsk No. 3 by 0.2 million tons per year each and No. 3 Berezniki by 0.14 million tons per year during the 1977-80 period.

The total output of the potassium mines in the U.S.S.R. exceeded 60 million tons of ore in 1979. The estimated level of potash output for 1980 was 18.5 million tons (41.6% K_2O). The U.S.S.R.'s major market for potash remains the centrally planned economy countries of East Europe.

Gross potash reserves are reported at 22.9 billion tons of 16% to 40% K_2O content (3.8 billion tons of K_2O). About two-thirds of the reserves are located at the Upper-Kama basin in the North Urals. Reserves are principally carnallite and sylvite with a 13% to 20% K_2O equivalent. The second largest reserve region (4.6 billion tons) is Starobinsk (Soligorsk) in Belorussia, which contains sylvite (16% to 20% K_2O). The third important basis, Livov Oblast' (2.9 billion tons), is in the West Ukraine. The reserves of potassium ores in the Karlyuksk deposit in Turkmen S.S.R. were reported in 1975 at 2 billion tons, and those of the Tuva-Gutansk deposit were reported at 400 million tons. The first discovery of potassium salt in the Western U.S.S.R. was recently made at Ladushkin in Kaliningrad Oblast'.

There are four potash-producing centers: Solikamsk-Berezniki on the western side of the Central Urals, Soligorsk in Belorussia, and Stebnikov and Kalush in the Western Ukraine. The following complexes, with a total annual capacity of 21.38 million tons (41.6% K_2O), were in operation in, 1978: Berezniki Nos. 1, 2, and 3, Solikamsk Nos. 1 and 2, Soligorsk Nos. 1, 2, and 3, and the first stages of the Novostebnikov and Kalush complexes. In 1979, three complexes were under construction: the second stage of the Soligorsk No. 4 in Belorussia, Berenzniki No. 4, and Novosolikamsk in the Urals.

Five potash-producing complexes, with a total annual capacity of 12.6 million tons, were in operation at the Uralkaliy (Urals potash) concern in 1979. It was planned to produce 14.3 million tons at this concern in 1980. Construction of the Berezniki No. 4 complex in this area began in 1973 and that of the Novosolikamsk complex in 1975. The total designed capacity of both complexes is 14 million tons per year (capacity of each is 7 million) of potassium chloride.

Belorussia produced about 50% of the total Soviet output of potassium fertilizers in 1979. There are three potassium complexes in operation with a total annual capacity of 6.5 million tons of fertilizers. The designed capacity of the Soligorsk complex is 16.6 million tons of ore (four shafts) and 5.5 million tons of potassium fertilizers. The first stage, with an annual capacity of 1.7 million tons of fertilizers (4 million tons per year of ore), of the Soligorsk No. 4 complex was completed in 1979. It was expected that the second stage (capacity 1. 8 million tons per year) of the complex would be completed in 1980. Three of Belorussia's complexes produced about 27 million tons of potassium ores and about 9 million tons of concentrate in 1979.

Fluorspar.—Despite the Soviet Union's effort to achieve self-sufficiency, it remained a net importer of fluorspar, mainly from Mongolia, Mainland China, and Thailand. Soviet consumption of fluorspar in 1979 was over 1 million tons. The iron and steel industry consumed more than 85% of the total, and consumption is increasing by 8,000 to 10,000 tons each year. Estimated levels of fluorspar output for 1980 was 550,000 tons.

The Maritime Territory (Yaroslavsk deposit), Transbaykal (Kalunguysk, Abagatuysk, Usuglinsk), Uzbekistan, and Kazakhstan were the main production areas in 1978-79. Small quantities of fluorspar are also produced in Tadzhikistan and other regions of the country. The mined ore contained from 20% to 45% CaF_2. The Central concentrator in Uzbekistan, which is treating ores with 24.3% to 26.5% CaF_2 content, produced a 95% CaF_2 concentrate with recovery of about 85%. The mine in Maritime Territory is treating ores with an average of 40.5% CaF_2 content with about 75% recovery in a 92% CaF_2 concentrate. During the 1976-80 period, it was planned to increase recovery and quality of calcium fluoride at the Yaroslavsk, Kalunguysk, and Takobsk complexes, and the Kyakhtinsk mine. Exploration of the Suppatash, Kengutan, and Shabres small deposits continued in 1979.

Mica.—The domestic supply of mica was augmented by large imports, despite the increasing use of substitutes. Strategic-grade mica continues to be imported from India to meet special industrial demands. Estimated output for 1980 was 47,000 tons.

Almost three-quarters of all muscovite mica production continued to come from the Mamsko-Chuyskiy region of Irkutsk Oblast'. Over 1,500 veins have been discovered in this area, and 9 small underground mines were in operation in 1978-79. The Irkutsk and Petrozavodsk mica factories are the largest in the U.S.S.R. Mica is also mined in Murmansk Oblast' on the Kola Peninsula, Kareliya, and Yakutiya.

The Kovdorslyuda (Kovdor mica) complex in Murmansk Oblast' operates the Yena, Pikolatva, and Kovdor underground mines and vermiculite open pit. Mining of vermiculite began here in 1960, and the capacity of the concentrator is 56,000 tons per year of concentrate. The Karelslyuda (Karel mica) complex in Karelia operates the Plotina, Malinovaya Varakka, and Tedino underground mines. Two 400-meter-deep exploratory shafts were sunk at the Malinovaya Varakka mine in 1979. It is planned to develop the Slyudyanoy Bor deposit in Karelia in the future.

Salt.—The Soviet Union is one of the world's leading countries for salt reserves, production, and exports. It was planned to increase salt production from 12.4 million tons in 1970 to 14 million tons in 1975, and to 20 million tons in 1980. However, the estimated production level for 1980 was revised to 15 million tons. Salt development is concentrated in the Donets Basin (40% of output), the Urals, East Siberia, Armenia, and West Ukraine. The increase in production came mainly from the Iletsk mine in Orenburg Oblast' and the Avansk mine in Armenia. Development of a new mine, with an annual capacity of 2 million tons, at Artemovsk in the Donets Basin continued in 1979. The Nizhniy Baskunchak salt complex, with capacity of 700,000 to 900,000 tons per year, was also under construction. The construction of the Verkhnekamsk salt complex in Perm Oblast and the renovation of the Iletsk mine continued in 1979. Construction of the Mozyr' salt complex in Belorussia (capacity 360,000 tons per year), which began in 1974, based on rock salt deposits which lie at a depth of up to 700 meters, continued in 1979.

The survey of the rock salt deposit near Gusev in Kaliningrad Oblast' was completed in 1976. Gross salt reserves in place were reported at 1,597 million tons including 88 million in category A, 266 million in category B, and 1,243 million in category C_1. The salt reserves in place in category C_2 are reported at 4,182 million tons. It is planned to develop new mines at this deposit with a capacity of 600,000 tons per year. The Kuuli-Sol complex in Turkmeniya, one of the country's larget suppliers of table salt, has shipped almost 800,000 tons of salt, part of which has been exported to Norway, Denmark, and Yugoslavia. The reserves of the lake, which extends for 10 kilometers along the eastern shores of the Caspian Sea, are very large. The complex's capacity has been increased, and it was planned to raise its output to 400,000 tons per year by the end of 1980. Rock salt is also produced in Tadzhikistan.

Sulfur.—The U.S.S.R. has large reserves of sulfur, but grades are low and costs high. The principal producers of native sulfur continue to be Rozdol (West Ukraine), Gaurdak in Turkmen S.S.R., Yavorov in West Ukraine, and the Volga group of the Kuybushev sulfur complex, which together produced the bulk of the country's requirements. The dressing mills of all four complexes are treating ore with a sulfur content from 8% to 40% and produce a flotation concentrate with a 70% to 85% sulfur content. Production doubled during the past decade as a result of growth both in the elemental sulfur and as byproduct output. Frasch and the Orenburg sour-gas sulfur projects have become important in the last few years, and it is expected that these sources will account for most future growth in the Soviet sulfur industry. The U.S.S.R. is currently ranked fourth in the world in terms of brimstone production. Estimated level of total sulfur output for 1980 was 11.0 million tons.

The native sulfur sources are concentrated in four regions: the Carpathians, Central Asia, Central Volga, and the Soviet Far East. Production is concentrated at the Carpathian sulfur basin, where the Rozdol' and Yavorov sulfur plants are currently in operation together with open pits, beneficiation plants, sulfur melting plants, and Frasch process production. The increase in the native sulfur production will depend on full-capacity operation of the Yavorov sulfur plant and the expansion of the Gaurdak and Yavorov Frasch installations.

About 30% of the total Soviet output of native sulfur is produced by the Frasch process at the Yavorov and Gaurdak plants, where production began in 1969. The deep-lying reserves at the Yazovsk, Nemirovsk, Tlumach, Sororsk, Zhidachevsk, Gumenetsk, Syreysk-Kamenodol'sk, Gaurdak, and other sites are the most suitable for the production of sulfur by the Frasch process. About 1 million tons of sulfur was recovered from Orenburg sour gas in 1978. The Soviet Mashinoimport foreign trade organization has issued invitations to bid for a 6-billion-cubic-meter-per-year high-sulfur gas processing complex which will include a 2-million-ton-per-year elemental sulfur plant. The complex is to be built near Astrakhan at a cost of some $1 billion. Reportedly, construction of the first stage of the Yavorov sulfur ore mining and processing complex in West Ukraine was completed in August 1978. Over 1 million tons of sulfur was recovered from sour gas in 1979.

There were three 100,000-ton-per-year installations using the Frasch process at the Gaurdak complex in operation in 1979. During the 1976-80 period, production of sulfur at Gaurdak was to increase by 50%

through the commissioning of a new open pit and expansion of Frasch production. The second stage of the Frasch plant at Gaurdak was put into operation in October 1979.

Production of sulfuric acid increased from 22.4 million tons in 1978 to an estimated 23 million tons in 1979. Sulfuric acid production began at the Voskresensk (near Moscow) mineral fertilizer complex in June 1979 with an annual capacity of 0.5 million tons. Construction of a second sulfuric acid plant began in 1979 with the same capacity; it is to be ready in 1981. A third of similar size is to be delivered within the next few years. Poland is building these plants and is also supplying the complex with the necessary raw sulfur. Over 40% of the total Soviet sulfuric acid production came from Polish plants in 1978-79, and by the end of 1980 this figure was to rise to 45%.

Talc.—Only the Onotsk deposit in Irkutsk Oblast', with an annual capacity of 45,000 tons, produced high-grade iron-free material. Despite large reserves and the development of new mines, imports of talc from North Korea and Bulgaria continued in 1978 and 1979. Estimated level of talc output for 1980 was 500,000 tons.

The Kirgiteysk deposit in Krasnoyarsk Kray was the major producer of lower quality talc. The Miass and Shabrovsk deposits in the Urals ranked second in output. Some talc is mined from the Tetri-Mindorskoye and Kvachevskoye deposits in South Osetinsk, Georgia. The raw material at the Onotsk deposit is shipped for processing to the Miass talc mill in the Urals. The Medvedevskoy talc deposit in Chelyabinsk Oblast' was under development in 1979.

MINERAL FUELS

Compared with 1975 output, the 1980 production of oil was to rise by 30%, natural gas by 55%, coal by 15%, hydroelectric power by 48%, and nuclear power by 333%.

The share of petroleum and natural gas in the total Soviet primary energy consumption increased from 65% in 1978 to 66% in 1979, while that of coal declined from 31% to 29%. Total consumption of all types of primary energy in the U.S.S.R. was expected to be equivalent to about 1,685 million tons of standard coal in 1980.

Soviet long-range forecasting placed the demand for raw coal and lignite at over 800 million tons in 1980 and 1 billion tons by 2000.

The primary energy balance of the U.S.S.R. for 1978 and 1979 is shown in table 9.

Table 9.—USSR: Total primary energy balance for 1978 and 1979

(Million tons of standard fuel equivalent)

	Production	Imports	Exports	Apparent consumption
1978:				
Total primary energy	1,814	34	314	1,535
Coal (lignite, anthracite, bitumous and coke)	498	12	32	478
Crude oil and petroleum products	813	12	240	585
Natural and associated gas	426	10	40	396
Peat	15	--	--	15
Oil shale	12	--	--	12
Hydropower	19	--	2	17
Nuclear power	6	--	--	6
Fuelwood	25	--	--	25
1979:				
Total primary energy	1.883	30	319	1,594
Coal (lignite, anthracite, bituminous and coke)	484	12	32	464
Crude oil and petroleum products	840	12	240	612
Natural and associated gas	484	6	45	445
Peat	9	--	--	9
Oil shale	12	--	--	12
Hydropower	23	--	2	21
Nuclear power	7	--	--	7
Fuelwood	24	--	--	24

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Coal.—In 1979, the Soviet Union produced an estimated 719 million tons (planned 753 million) of run-of-mine coal as follows: bituminous coal, 473 million tons; anthracite, 79 million tons; and lignite, 167 million tons. Estimated according to Western practice, this was equivalent to 413 million tons of "clean coal," placing the U.S.S.R. second among the world's coal producers. Over 33% of the total output was surface-mined.

Production of raw coal and lignite in 1978-79 was from Donets, 31%; Kuznetsk, 19%; Karaganda, 7%; Moscow, 4%; Kansk-Achinsk, 4%; Pechora, 4%; and other areas, 31%. There were about 800 underground mines with an average annual capacity of some 600,000 tons of raw coal, and 70 open pits with an average annual output of 3.4 million tons of run-of-mine coal and lignite.

The annual capacity of coal and lignite mines increased by 26 million tons (raw coal and lignite) in 1978 and by 19 million tons in 1979. In 1980, the reduced planned production of raw coal and lignite was to reach 745 million tons, but actual output (based on the 1979 result) comprised about 730 million tons.

Preparation of coal for the market does not play a great role in the industry and is normally restricted to coking coals and coal for export. The shortage of coal preparation facilities forced Soviet planners to place greater emphasis on improvement in quantity as an expedient.

Practically all Soviet coal requires upgrading, but of the 724 million tons produced in 1978, only an estimated 297 million tons was treated to produce an estimated 157 million tons of clean coal. In 1979, only an estimated 345 million tons was treated to produce an estimated 182 million tons of clean coal. Some 66 preparation plants are treating coking coal, 38 plants are processing anthracite, and 50 preparation plants are treating coal and lignite for powerplants.

The official average ash content of coal shipped to consumers in 1979 was about 20.3%. The average calorific value of coal from the Karaganda, Kuznetsk, and Donets basins fell by 600, 900, and 1,200 kilocalories, respectively, during the last decade. Up to 40 million tons of substandard-quality coals and lignite are delivered to thermal powerplants annually, or about 20% of the total requirements of these plants.[88]

Total Soviet economically minable coal and lignite reserves in place in categories $A+B+C_1$ in January 1975 were 420,000 million tons, including 87,000 million tons of coking coal and 190,000 million tons of lignite. Over 70% of the total coal and lignite reserves are located in the eastern (Asian) part of the U.S.S.R.

Natural Gas.—In 1980, the output of natural gas was to reach 435 billion cubic meters. According to Soviet data, gas reserves in place in the $A+B+C_1$ categories as of January 1978 were 29,000 billion cubic meters, 15% of which were in the European part of the U.S.S.R., 72% in Siberia and the Soviet Far East, and 13% in Central Asia and Kazakhstan.

Petroleum.—The Soviet Union is rich in oil. However, despite the new discoveries, the rate of growth in reserves is lagging behind the rate of growth in extraction. According to Soviet sources, crude oil reserves in place in the $A+B+C_1$ categories as of January 1979 were 12.9 billion tons. A 30% to 40% recovery of crude oil in place was claimed in 1979.

For the sixth year, the U.S.S.R. remained the world's largest oil producer. The country continues to expand its exports of crude oil and petroleum products even though the quantities available for internal consumption have been inadequate. The Soviet Union became a net exporter of crude oil in 1951 and of petroleum products in 1954 and has gradually stengthened its position since that time. The U.S.S.R. exported about 30% of its production in 1979.

In 1979, over 500 (including 36 large) oil and gas condensate fields were in operation, with a total of about 77,000 wells. Most of the increased production was derived from the West Siberian fields. There were about 150 oilfields in Western Siberia in January 1980, including 50 fields "ready for operation." The Samotlor oil field in Tyumen' Oblast', the largest oil field in the U.S.S.R., accounted for the production of some 145 million tons of crude in 1979. Over 2,000 production wells were in operation at this field in 1979. The Fedorov field was the second largest in West Siberia in 1979.

Crude oil extraction (including condensate) is planned to be increased to 606 million tons in 1980, almost in line with the lower range of the present 5-year plan. Investment in oil has increased from 3,802 million rubles in 1975 to 4,450 million in 1977, 6,000 million in 1979, and probably about 7,000 million in 1980. The output of crude and gas condensate will rise less rapidly beyond 1980, and will reach about 675 million tons in 1985. The main increase will be from the fields in West Siberia. In 1985 crude oil output has been estimated on the basis of projections from earlier years, as modified by information in the long-range plan. The Volga-Urals area will continue to decline in relative importance, whereas Tyumen' Oblast' in West Siberia will make the most notable gains.

The anticipated date of peaking of the Samotlor fields, the largest in the U.S.S.R., is 1979-86 and that of the Fedorovsk field is 1983-90. There is no reason, therefore, why the growth in petroleum production will not continue into the 1980's. The U.S.S.R. will continue importing a high level of petroleum equipment and technology. With current Soviet technology and partially with equipment from the West, oil output in the U.S.S.R. could peak between 1986 and 1989.

Contrary to continuing reports that the U.S.S.R. would no longer increase its oil deliveries to its Comecon partners, some countries reported slight increases in deliveries in 1979. Soviet exports of petroleum to the East European Comecon countries are still increasing at present, more or less in line with existing trade agreements, but in the future the increase will probably be smaller. The Soviets have an explicit policy to limit oil exports to the Comecon countries of East Europe and assist them in expanding their domestic coal and nuclear energy production.

Based on signed trade agreements and the latest Soviet forecasts, oil exports (crude oil and products) from the U.S.S.R. were expected to increase from 130 million tons in 1975, 149 million in 1976, and an estimated 155 million in 1979 to 160 million tons in 1980. Soviet petroleum exports to market-economy countries were 53 million tons in 1975, 65 million in 1976, and an estimated 65 million in 1979; the probable figure for 1980 was 66 million tons.

Oil has long been a major export earner for the U.S.S.R., and it is intended to become more important. In recent years there has been a growing emphasis on Soviet coal and natural gas production, making more petroleum available for export. In terms of value, the exports of petroleum rose from 25% of total Soviet official exports in 1975 to 28% in 1976 and also 28% in 1978. (The trend runs counter to any forecast that the U.S.S.R. might become a major importer of petroleum after 1980.) Despite rising Soviet domestic consumption of oil, deliveries to centrally planned economy countries should increase according to obligations entered into, and deliveries to the West should stay at the same level or increase only slightly. The Soviet preference, however, is to sell to the West more refined products, as compared to crude.

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[44] Work cited in footnote 43.

[45] Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 8, February 1979, pp. 1-2.

[46] Pravda (Moscow). November 1979, p. 2.

[47] Sotsialisticheskaya industriya (Socialist Industry), Moscow. Sept. 24, 1977, p. 2.

[48] Stroitel'naya gazeta (Construction Gazette), Moscow. May 1979, p. 4.

[49] Work cited in footnote 37.

[50] Kazakhstanskaya pravda (Alma-Ata). Apr. 13, 1979, p. 2.

[51] Work cited in footnote 43.

[52] Kazakhstanskaya pravda (Alma-Ata). Jan. 5, 1980, p. 2.

[53] Kazakhstanskaya pravda (Alma-Ata). July 28, 1979, p. 2.

[54] Razvedka i okhrana nedr (Exploration and Conservation of Mineral Resources), Moscow. No. 2, February 1979, p. 46.

[55] Rabochaya gazeta (Worker's Gazette), Kiev. Aug. 16, 1978, p. 3.

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The Mineral Industry of the United Arab Emirates

By Candice Stevens[1]

The petroleum industry of the United Arab Emirates contributed over 65% of the gross domestic product (GDP) of $13.9 billion[2] in 1978 and an estimated $16 billion in 1979. Increasing petroleum revenues have accounted for the 90% growth in the GDP of the seven former Trucial Coast sheikdoms since 1972. In 1978, the emirates agreed upon the need for an overall development plan and established a Federal Planning Authority to outline national objectives of economic and social development. Emphasis was placed on diversifying sources of income, using capital-intensive projects owing to the scarcity of labor, developing education and training systems to meet manpower requirements, and encouraging individual initiative in the private sector. The federal budget of the United Arab Emirates was $2.8 billion in 1978 and $2.6 billion in 1979, most of which was contributed by Abu Dhabi. Since 1974, the Abu Dhabi Fund for Arab Economic Development has disbursed loans and grants of more than $1 billion per year to foreign countries.

General aspects of exploration and development of oil and minerals in the United Arab Emirates are under the direction of the Ministry of Petroleum and Mineral Resources. Although united politically, the oil-producing emirates of Abu Dhabi, Dubai, and Sharjah exercised independent control over their petroleum policies. Abu Dhabi maintained a 60% share in major oil operations and required 51% interest in all ventures to exploit natural gas. In 1978, Abu Dhabi issued Law No. 8 for the conservation of hydrocarbon resources, which required measures for prevention of damage to oil-bearing structures, detailed studies for oil exploration and production programs, and official permission to flare natural gas. In 1979, Abu Dhabi promulgated new commercial regulations that required foreign firms to do business through local branches and permitted trade licenses only to companies wholly owned by Abu Dhabi nationals. Dubai nationalized its oil and gas industries in 1975 but retained foreign shareholders under management contracts. Sharjah acquired 25% interest in domestic oil operations and opted for a 60% share in any new vetures. Foreign oil companies were engaged in exploration in the various emirates under diverse types of production-sharing agreements.

Abu Dhabi and Dubai initiated infrastructure construction for their new industrial centers. Fluor Corp. (United States) was contracted for overall planning and construction management for the city of Ruweis in Abu Dhabi. Projects included an oil refinery, a natural gas liquids (NGL) plant, a petrochemical complex, a fertilizer plant, and an iron and steel complex. Infrastructure for Ruweis, which was to require 10 to 12 years for completion, comprised a port with three major shipping terminals, a residential community, and airport modernization. The new industrial city of Jebel Ali in Dubai was to include an aluminum smelter, an NGL facility, a steel plant, a fertilizer plant, and a petroleum refinery.

An expansion in port handling capacity was a major priority of the United Arab Emirates. The Abu Dhabi Petroleum Ports Operating Co. was established in 1978 with Lamnalco Ltd. (United Kingdom) as manager. The company was to manage the Jebel Dhanna port, supervise construction of a new deepwater port at Ruweis and an oil terminal on Zirku Island, and oversee feasibility studies for a drydock project. In Dubai, the worlds largest drydock was under construction by Costain-Taylor Woodrow (United Kingdom) and was scheduled to be operational in 1980. The new deepwater port at Jebel Ali, managed by SeaLand Services Inc. (United States), was partially commissioned in 1979. Sharjah's intermodal transportation port system came onstream in 1978 with the commissioning of the specialized container facility at Khor Fakkan. A new deepwater port in Ras al-Khaimah was to be completed in 1980.

PRODUCTION AND TRADE

Petroleum production decreased in 1978 owing to the imposition of production ceilings by Abu Dhabi, which accounted for about 80% of the oil production of the United Arab Emirates. New fields under development in Abu Dhabi were expected to raise production capacity to more than 2 million barrels per day by 1981. Petroleum reserves in Abu Dhabi, Dubai, and Sharjah were estimated at 40 billion barrels. Abu Dhabi produced refined petroleum products and NGL; new facilities coming onstream in Abu Dhabi and Dubai were to greatly increase output of both commodties. The emirates of Abu Dhabi, Dubai, Sharjah, and Ras al-Khaimah produced cement and new plants were under construction. Mineral production in the United Arab Emirates is given in table 1.

The United Arab Emirates evidenced a balance-of-trade surplus of $4.6 billion in 1978 and $6 billion in 1979. Exports of oil and gas, valued at $8.7 billion in 1978 and $11.5 billion in 1979, accounted for 90% of export value. In 1978, the United Arab Emirates exported 381,000 barrels per day of crude oil to the United States amounting to 6% of U.S. petroleum imports. The import bill of the United Arab Emirates increased from $560 million in 1972 to more than $5 billion in both 1978 and 1979. Japan was the United Arab Emirates' most important trading partner, taking 30% of petroleum exports and supplying about 20% of total imports. Imports from the United States were valued at $540 million in 1978 and $575 million in 1979.

Table 1.—United Arab Emirates[1]: Production of mineral commodities

Emirate, commodity,[2] and unit of measure	1976	1977	1978[p]	1979[e]
ABU DHABI				
Cement, hydraulic .... thousand metric tons..	200	200	200	[illegible]
Gas, natural:				
Gross production .... million cubic feet..	544,196	541,760	478,617	500,000
Marketed production[3] .... do....	37,787	111,876	177,914	200,000
Natural gas liquids .... thousand 42-gallon barrels..	--	8,411	4,983	15,000
Petroleum:				
Crude .... do....	580,476	602,761	527,827	600,000
Refinery products:				
Gasoline .... do....	554	1,073	NA	NA
Kerosine .... do....	22	188	NA	NA
Distillate fuel oil .... do....	963	1,390	NA	NA
Residual fuel oil .... do....	702	1,045	NA	NA
Other .... do....	9	37	NA	NA
Refinery fuel and losses .... do....	127	306	NA	NA
Total .... do....	2,377	4,039	4,745	[illegible]
AJMAN				
Marble[e] .... square meters..	26,000	26,000	26,000	[illegible]
DUBAI				
Cement, hydraulic .... thousand metric tons..	--	--	370	[illegible]
Gas, natural:[e]				
Gross production .... million cubic feet..	127,600	130,000	147,000	[illegible]
Marketed production .... do....	20,000	31,000	30,600	[illegible]
Petroleum, crude .... thousand 42-gallon barrels..	114,704	116,472	132,240	[illegible]
RAS AL-KHAIMAH				
Cement, hydraulic .... thousand metric tons..	450	450	450	[illegible]

See footnotes at end of table.

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Table 1.—United Arab Emirates[1]: Production of mineral commodities —Continued

Emirate, commodity,[2] and unit of measure	1976	1977	1978[p]	1979[e]
SHARJAH				
Cement, hydraulic do	--	50	263	300
Gas, natural, gross production[4] million cubic feet	15,000	15,000	15,000	15,000
Petroleum, crude thousand 42-gallon barrels	13,542	10,293	8,067	8,750

[e] Estimate. [p] Preliminary. NA Not available.

[1] In addition to the Emirates listed, Fujairah and Umm al-Qaiwain record no mineral production but presumably produce small quantities of crude construction materials.

[2] In addition to the commodities listed, crude construction materials such as common clays, stone, and sand and gravel presumably are produced, but output is not recorded quantitatively and general information is inadequate to make reliable estimates of output levels.

[3] Includes gas reinjected to reservoirs, if any.

[4] No marketed production is reported; there is probably some small field use.

Table 2.—Abu Dhabi: Exports of crude oil, by destination

(Thousand 42-gallon barrels)

Destination	1976	1977	1978
Australia	220	2,081	NA
Canada	2,855	--	NA
France	76,128	72,706	NA
Germany, Federal Republic of	17,934	32,741	NA
Italy	14,384	11,899	NA
Japan	192,004	191,005	NA
Netherlands	66,758	87,126	NA
United Kingdom	38,357	25,842	NA
United States	80,557	101,580	NA
Other	89,961	74,604	NA
Total	579,158	599,586	522,644

NA Not available.

Source: Organization of Petroleum Exporting Countries, Statistics Unit. Annual Statistical Bulletin 1978 (Vienna). 1979, p. 75.

COMMODITY REVIEW

METALS

Aluminum.—Arrangements for financing the United Arab Emirates' first aluminum smelter were nearing completion. In 1979, the Dubai Aluminum Co. (DUBAL) received a $230 million Eurocurrency loan arranged by a consortium of international banks. In addition, the British Export Credits Guarantee Department allocated $320 million in support of British Smelter Constructions, the main contractor on the smelter located in Jebel Ali, Dubai. Production was to begin in early 1980. The smelter was owned 80% by the Dubai Government, 7.5% by Southwire Aluminum Co. (United States), 7.5% by Nissho-Iwai Co. Ltd. (Japan), and 5% by local interests. Annual production capacity was to be 135,000 tons of billets rising to 180,000 tons of billets by the mid-1980's. Fuel was to be supplied by the Dubai Natural Gas Co. (DUGAS) plant under construction in Jebel Ali. The DUBAL smelter's power station, with an installed generating capacity of 515 megawatts, would be the largest industrial gas turbine powerplant outside North America. An agreement was reached with Alcoa of Australia for the supply of 200,000 tons of alumina per year for 10-year period.

In August 1978, Gulf Extrusions Ltd. brought into production Dubai's first aluminum extrusion plant in Jebel Ali. The $10 million plant produced 3,000 tons per year of various aluminum shapes. Billets were obtained from Aluminum Bahrain Ltd. (ALBA) in 1978 and were to be supplied in the future by the DUBAL smelter. An aluminum cable plant, with a nominal capacity of 1,500 tons per year, was also under construction.

Iron and Steel.—In October 1978, the Abu Dhabi Executive Council approved the establishment of a major iron and steel complex in the new industrial city of Ruweis. A $200,000 contract for a feasibility study of the project was awarded to Eisenbau A.G. (Federal Republic of Germany). The plant was to have an annual production

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capacity of 400,000 tons of steel and was to use locally produced natural gas. It was reported that Abu Dhabi and India were studying a possible joint venture to finance the project. In 1978, Abu Dhabi imported approximately 160,000 tons of steel.

NONMETALS

Asbestos.—An asbestos plant was inaugurated in June 1979 in Umm al-Qaiwain. The $22 million plant had an annual production capacity of 40,000 tons of asbestos pipes, sheets, and plates. A study was being conducted on expanding the plant's capacity to 120,000 tons per year of asbestos products for export.

Cement.—Cement production increased to 1.3 million tons in 1978 from 700,000 tons in 1977 as the new Dubai National Cement Co. plant came onstream. Constructed by Costain Civil Engineering (United Kingdom) at a cost of $65 million, full production capacity of the plant was 500,000 tons per year. The Gulf Cement Co. was to construct a 1-million-ton-per-year cement plant in Ras al-Khaimah. Ishikawajima-Harima Heavy Industries Co. Ltd. (IHI) (Japan) was contracted for construction of the $68 million plant which was to begin production in 1982. Fujairah Cement Industries contracted Voest-Alpine A.G. (Austria) for the construction of 520,000-ton-per-year cement plant to be onstream in 1982. Production capacity of the United Arab Emirates' four operating cement plants was as follows:

Location	Operator	Capacity (tons per year)
Al Ain, Abu Dhabi	Union Cement Co.	200,000
Ras al-Khaimah	do	500,000
Sharjah	Sharjah Cement Co.	270,000
Dubai	Dubai National Cement Co.	500,000

Fertilizer Materials—A nitrogen fertilizer plant came onstream in Sharjah in 1978. The $5 million facility had a production capacity of 10,000 tons per year of fertilizer which were to increase to 36,000 tons per year by 1979.

The Abu Dhabi National Oil Co. (ADNOC) appointed Creusot-Loire (France) as project manager for the nitrogen fertilizer complex to be constructed in Ruweis. Daily production capacity was to be 2,000 tons of ammonia and 1,500 tons of urea. Natural gas from Abu Dhabi's onshore oilfields was to be used as feedstock. ADNOC also entered into two joint ventures for the construction of nitrogenous fertilizer plants in Pakistan and Tunisia. Pak Arab Fertilizers Ltd., owned 48% by ADNOC and 52% by West Pakistan Industrial Development Corporation, was to construct a 1,000-ton-per-day plant in Multan, Pakistan. The Arab Co. for Phosphatic and Nitrogenous Fertilizers, owned 40% by ADNOC, was to construct a 1,000-ton-per-day plant in Tunisia.

MINERAL FUELS

Natural Gas.—The Das Island natural gas plant, commissioned in October 1977, operated at half capacity in 1978 owing to technical difficulties and a decline in gas output from Abu Dhabi's offshore oilfields. The plant, which was expected to reach full capacity by 1980, was designed to process 550 million cubic feet per day of gas and to produce 15 million barrels of liquefied natural gas (LNG), 5.6 million barrels of liquefied petroleum gas (LPG), 1.5 million barrels of light distillate, and 1.6 million barrels of pelletized sulfur per year. Abu Dhabi Gas Liquefaction Co. Ltd. (ADGLIC) was owned 51% by ADNOC, 22.1% by Mitsui and Co., 16.3% by British Petroleum Co. Ltd. (BP), 8.2% by Compagnie Française des Petroles (CFP), and 2.4% by Bridgestone Liquefied Gas Co.

In 1978, ADGLIC awarded Stone and Webster (United Kingdom) a contract to recover and transport associated gas from the offshore Lower and Upper Zakum Fields to compensate for any shortfall in gas available from Umm Shaif Field. The gas-handling system was to recover 300 million cubic feet per day of gas for transmission to the existing platform at Umm Shaif Field and then to the Das Island LNG facility. It was due for completion in 1980. Also in offshore Abu Dhabi, the Abu Dhabi Marine Areas Operating Co. (ADMA-OPCO) reported a major gas discovery west of the Umm Shaif Field. The test well yielded 80 million cubic feet per day of gas from a depth of 15,200 feet. A deep gas exploration well was also to be drilled near Zakum Field in 1980.

Abu Dhabi Gas Industries Ltd. (GASCO) was established in 1978 to gather and process associated gas from Abu Dhabi's onshore oilfields. GASCO was owned 68% by ADNOC, 15% by Shell, 15% by CFP, and 2% by the Portuguese Participations and Exploration Corp. (PARTEX). The joint venture planned to process associated gas from the Bab, Bu Hasa, Asab, and Sahil Fields and produce 185,000 barrels per day of

NGL. Fluor Corp. (United States) was contracted to design and supervise the construction of gas-gathering facilities. Bechtel Inc. (United States) was contracted for the design and construction of the fractionation plant at Ruweis. Saipem (Japan) was to construct an NGL export terminal and tanker loading facilities at Ruweis. The project, estimated to cost $1.6 billion, was to come onstream in 1981.

The natural gas processing plant under construction by DUGAS in Jebel Ali, Dubai, was scheduled to begin export operations in January 1980. DUGAS is a joint venture of the Dubai Government and Scimitar Oils Ltd. of Canada (formerly Sunningdale Oils. Ltd.). The facility was to process 125 million cubic feet per day of associated gas from offshore Fateh and Southwest Fateh Fields and produce 20,000 barrels per day of NGL. Oceanic Contractors Inc., a subsidiary of J. Ray McDermott (United States), was contracted for the design and construction of the processing facility. The gas-gathering system included two offshore compression platforms, 105 kilometers of subsea pipeline, and an export terminal at Ruweis. C. Itoh of Japan contracted to purchase nearly 60% of output for 15-year period.

A gas well drilled offshore Umm al-Qaiwain by Zapata Exploration Co. was abandoned as dry at 18,700 feet. An agreement previously concluded with DUGAS for development and sale of the gas was canceled in 1978. The DUGAS agreement was dependent on studies confirming that gas reserves were sufficient to meet minimum delivery needs. The Umm al-Qaiwain Oil Group planned to continue drilling in the offshore area in the hope of eventually exporting gas to Dubai for use in the Jebel Ali aluminum smelter.

Petroleum.—*Abu Dhabi.*—In 1978, the Government-owned ADNOC increased its decisionmaking role in the two major oil companies, Abu Dhabi Petroleum Co. (ADPC) and the Abu Dhabi Marine Areas. Ltd. (ADMA). Under a participation agreement reached in 1974, ADNOC held a 60% interest in both groups. New companies established in 1978 would be managed by a nine-member board comprising three members from ADNOC in addition to representatives of the other shareholders. The companies were to be registered locally and to undertake an active program to employ and train local personnel. ADPC was replaced by the Abu Dhabi Company for Onshore Oil Operations (ADCO) and ADMA was replaced by the Abu Dhabi Marine Areas Operating Co. (ADMA-OPCO). Shares in ADCO were held 60% by ADNOC, 9.5% by BP, 9.5% by CFP, 9.5% by Shell, 4.75% by Exxon, 4.75% by Mobil, and 2% by PARTEX. Shares in ADMA-OPCO were held 60% by ADNOC, 14.67% by BP, 13.33% by CFP, and 12% by the Japan Oil Developmet Co. (JODCO).

ADCO worked under a production ceiling of 850,000 barrels per day in 1978 and 1979 and this was to be lowered even further to 740,000 barrels per day in 1980. Production capacity of the onshore Bab, Bu Hasa, Asab, and Sahil Fields was rated at 1.3 million barrels per day. The new Shah Field, located south of Asab Field, was brought onstream in 1979 with an initial production capacity of 50,000 barrels per day. The two major offshore fields operated by ADMA-OPCO were limited to an average output of 500,000 barrels per day in 1978 and 1979 and this was to remain unchanged in 1980. Water injection programs were completed in the Zakum and Umm Shaif Fields and each maintained a production rate of 250,000 barrels per day.

The balance of Abu Dhabi's oil production came from smaller offshore fields. Amerada Hess Corp. operated the Abu Al Bu Koosh Field and brought the Arzanah Field onstream in mid-1979 at an initial production rate of 22,000 barrels per day. The Mubarraz Field, operated by the Japanese consortium Abu Dhabi Oil Co. Ltd. (ADOC), produced about 18,000 barrels per day of oil. In 1978, ADOC was awarded additional offshore acreage totaling 1,580 square kilometers. In 1979, Qatar and Abu Dhabi made a joint decision to shut down the El Bundug Field owing to reservoir pressure maintenance problems.

Two new companies were formed in 1978 to develop two offshore fields. The Zakum Developmet Co, owned 88% by ADNOC and 12% by JODCO, was to exploit the Upper Zakum Field at an initial rate of 500,000 barrels per day. CFP was appointed overall manager of the project and was to develop technology to enhance recovery from the low-pressure field. Recoverable reserves were estimated at 16 billion barrels. Foster Wheeler Corp. (United States) won a contract for overall construction supervision services for an export terminal to be built on Zirku Island. R. J. Brown and Associates (Switzerland) was to engineer and construct

500 kilometers of subsea pipeline. Total cost of the project was estimated at $500 million. The Umm al-Dalkh Development Co. was created as a joint venture between ADNOC (88%) and JODCO (12%) to exploit the Umm al-Dalkh Field. Umm al-Dalkh was expected to produce 50,000 barrels per day of oil by 1981 with production exported from the Zirku Island terminal.

Deliveries of Bab crude to the Umm al-Nar Island petroleum refinery averaged 13,000 barrels per day. A lube oil blending plant was inaugurated on Umm al-Nar Island in 1979 to produce 100,000 barrels per year of lubricants for the local market. The United Arab Emirates imported more than 75% of its requirements for refined products. A $650 million refinery was scheduled to begin production in Ruweis in 1981. Snam Progetti (Italy) was overall construction manager for the project. Projected capacity was 120,000 barrels per day.

Ajman.—Forma Exploration Co. (United States) and Londo and Scottish Marine Oil Co. Ltd. (United Kingdom) were awarded a 35-year concession in Ajman's offshore. The company contracted to spend a minimum of $10 million on exploration work in its 300-square-kilometer tract.

Dubai.—The Dubai Petroleum Co. (DPC) continued its water injection program to increase the production capacity of the Fateh and Southwest Fateh Fields to 460,000 barrels per day. DPC began production from the offshore Rashid Field in June 1979 at the rate of 2,000 barrels per day of condensate. DPC expected to begin production from the Falah Field in 1980 at an initial rate of 15,000 barrels per day of oil.

Ras al-Khaimah.—In 1978, Ras al-Khaimah amended its tax laws in an attempt to increase oil exploration activities. Gulf Oil Co. and Amoco were awarded a 1,630-square-kilometer onshore concession. Offshore, feasibility studies were in progress on the development of two oil discoveries which could lead to the production of 70,000 barrels per day of oil by 1983. Kellogg Inc. (United States) was conducting engineering studies for the construction of petroleum refinery in Khor Kuwait. The project was a joint venture between Ras al-Khaimah Oil Co. (RKOC) (51%) and the Kuwait National Petroleum Co. (49%). The refinery, was to process Kuwaiti crude oil and produce 120,000 barrels per day of petroleum products for both domestic use and export.

Sharjah.—In 1978, Crescent Petroleum Co. settled its dispute with the Sharjah Government over tax and royalty rates on production from the offshore Mubarek Field. The tax rate was raised from 55% to 65.65% in 1978 and to 77% in January 1979. Royalty rates were increased from 12.5% to 14.5%. The agreement was made retroactive on July 1, 1977, and Crescent Petroleum Co. was to pay the Sharjah Government approximately $13 million in back payments. In 1978, exploration concessions were awarded to Amoco Sharjah Oil Co. and a joint venture of Forman Exploration Co. and London and Scottish Marine Oil Co. Ltd.

Umm al-Qaiwain.—The Umm al-Qaiwain Oil Group, with Zapata Exploration Co. as operator, abandoned two oil and gas discoveries as uncommercial in 1978. The group planned to continue its exploration activities in the 1,200-square-kilometer offshore concession area.

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[1] Economist, Branch of Foreign Data.

[2] Where necessary, values have been converted from United Arab Emirates dirhams (UAED) to U.S. dollars at the rate of UAED3.86 = US$1.00

The Mineral Industry of the United Kingdom

By William F. Keyes[1]

A sustained rise in consumer expenditures was largely responsible for the rapid expansion of the British economy in 1978, but slower growth and higher inflation undermined the economy in 1979. Industrial production grew at 3% to 4% in real terms during both years, but after discounting the steady increase in crude petroleum production, this growth was reduced to 2.1%. The gross national product (GNP), in terms of 1978 prices, increased to £141 billion[2] (about $275 billion) in 1978, reflecting an increase of 13.8%, over the previous year's GNP. This increase, however, was equivalent to 3.0% in constant terms. The GNP in 1979 was estimated at £160 billion.

The minerals and metals economy of the United Kingdom ranked among the dozen largest in the world. The country is particularly well provided with fuels, both onshore, in the form of coal, and offshore, in the form of oil and gas. Nevertheless, the industry's performance was disappointing during the 1978-79 period, except for that of the petroleum sector. The nationalized coal mines and steel plants suffered large operating losses. The country's major potash mine still had not reached full-capacity production after 6 years. Two tin mines that constituted half the tin industry were closed, although plans were afoot to reopen them. Needed aluminum expansion remained in doubt because of high electricity costs. In addition, the North Sea oilfields were approaching full output more slowly than was originally planned.

The Mining Association of the United Kingdom expressed hope that the Government would soon respond to the recommendations of the Stevens Report, completed in 1974, which urged changes in planning control of mining operations. Another stimulus to mining which the association called for was reinstatement of Regional Development Grants, which had been withdrawn in 1976. For the first time under the Mineral Exploration and Grants Act of 1972, the Department of Industry did, however, grant aid for minerals exploration in the amount of £1.6 million in the year ending March 1978. Forty-four companies applied for aid in 1978, requesting a total of £2.5 million, and awards amounted to about £1 million in the year that ended March 1979.

PRODUCTION

The index of mining and quarrying production increased notably during the period, from 187.7 in 1977 to 232.5 in 1978 and to 294.2 in 1979 (1975=100). The increases were largely due to the continued growth in oil production from the North Sea, which was reflected in the extraordinarily high and increasing index of "other mining and quarrying;" this index went up from 638.6 in 1977 to 895.0 in 1978 and 1,241.0 in 1979. Movement of the index of metal manufactures was mixed; the ferrous metals index increased from 99.8 in 1977 to 102.7 in 1979, and the nonferrous metals index declined from 108.5 to 104.4 in the same period. The coal production index declined from 90.1 to 89.4. The total index for all industries during this period increased from 106.0 to 112.7.

Production of minerals in the United Kingdom in 1978 and 1979 is reported in table 1.

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Table 1.—United Kingdom: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity		1976	1977	1978[p]	1979[e]
METALS					
Aluminum:					
Alumina		96	99	94	100
Metal:					
Primary	tons	334,535	349,725	346,200	360,474
Secondary	do.	205,848	200,848	193,748	[illegible]
Cadmium metal, including secondary	do.	190	295	291	410
Copper:					
Ore and concentrate, metal content	do.	600	450	135	--
Metal, refined:					
Primary	do.	[r]51,557	44,397	46,158	[1]48,512
Secondary	do.	[r]85,680	77,827	79,403	[1]73,185
Total	do.	137,237	122,224	125,561	[1]121,697
Iron and steel:					
Iron ore		4,582	3,745	4,240	4,300
Metal:					
Pig iron		13,713	12,138	11,434	13,100
Ferroalloys, blast-furnace: Ferromanganese		122	97	60	[illegible]
Steel, crude		22,274	20,411	20,311	21,500
Semimanufactures:					
Sections		5,238	4,878	4,949	NA
Wire rods		1,538	1,650	1,424	NA
Plates and sheets		7,144	6,821	6,858	NA
Strip		1,264	1,134	1,144	NA
Pipe, tube, stock		711	687	727	NA
Railway track material		226	262	233	NA
Other rolled[2]		978	1,081	1,014	NA
Casting and forgings		360	338	307	NA
Total		17,459	16,851	16,656	NA
Lead:					
Mine output, metal content	tons	7,100	7,758	4,582	3,000
Metal:					
Bullion from imported ores and concentrates	do.	[r]16,502	35,015	30,371	[1]22,314
Refined:					
Primary[3]	do.	[r]132,157	139,654	122,841	[1]124,138
Secondary[4]	do.	209,711	211,424	222,947	[1]244,192
Total	do.	341,868	351,078	345,788	[1]368,330
Magnesium metal, including secondary	do.	3,000	2,700	2,700	2,700
Nickel metal, refined, including ferronickel	do.	[r]33,125	23,156	21,367	15,000
Silver metal	thousand troy ounces	108	134	41	NA
Tin:					
Mine output, metal content	tons	[r]3,323	4,100	3,132	2,800
Metal:					
Primary	do.	[r]11,161	10,458	8,445	8,000
Secondary	do.	[r]2,545	3,398	2,711	[illegible]
Tungsten, mine output, metal content	do.	[e]10	78	65	[1]25
Zinc:					
Ore and concentrate, metal content	do.	4,800	7,551	2,718	NA
Metal, smelter	do.	[r]41,583	81,481	73,575	76,000
NONMETALS					
Barite and witherite		50	50	54	54
Bromine	tons	29,900	24,700	25,100	25,000
Calcite		16	14	13	NA
Cement, hydraulic		15,780	15,456	15,916	16,140
Chalk		15,941	16,253	16,781	NA
Clays:					
Fire clay		1,513	1,764	1,404	NA
Fuller's earth		201	223	218	100
Kaolin (china clay)		3,847	4,338	4,199	4,300
Pottery clay and ball clay		14	16	16	NA
Other, including clay shale		26,229	24,378	25,473	NA
Diatomite	tons	3,500	2,000	2,000	2,000
Feldspar (china stone)[e]	do.	50,000	50,000	50,000	50,000
Fluorspar:					
Acid grade		134	105	130	NA
Metallurgical grade		[r]29	23	16	NA
Ungraded		[r]54	66	43	NA
Total		217	194	189	200
Gypsum and anhydrite[5]		3,350	3,310	3,322	3,300

See footnotes at end of table.

Table 1.—United Kingdom: Production of mineral commodities —Continued

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Mica	1	--	--	--
Nitrogen, N content of ammonia	1,348	1,631	1,600	1,630
Potash, K_2O equivalent	41	73	136	450
Refractory products:[6]				
Brick	809	768	673	NA
Cement	64	61	54	NA
Other	457	452	459	NA
Salt:				
Rock	611	905	1,311	1,350
Brine	1,918	1,871	1,760	4,200
Other	5,477	5,426	4,239	1,800
Sodium compounds: Sodium carbonate[e]	1,400	1,500	1,600	1,600
Stone, sand and gravel:				
Chert and flint	322	39	52	NA
Igneous rock	37,215	35,613	32,250	NA
Limestone and dolomite	89,364	85,992	88,819	NA
Sandstone, including ganister	13,522	11,755	13,407	NA
Slate	295	1,824	945	NA
Sand and gravel:				
Common sand and gravel	117,700	110,063	110,200	NA
Special sands	5,678	3,288	6,224	NA
Strontium minerals ... tons	5,400	5,100	5,000	5,000
Sulfur, byproduct:				
Of metallurgy	37	61	47	50
Of spent oxides	6	5	5	5
Unspecified	74	65	70	70
Total	117	131	122	125
Talc, soapstone, pyrophyllite ... tons	14,800	15,000	18,000	18,000
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	214	193	198	200
Coal:				
Anthracite	2,363	2,529	2,952	3,000
Bituminous	119,845	118,145	118,743	118,000
Other	1,592	1,426	1,882	1,808
Total	123,800	122,100	123,577	[1]122,808
Coke:				
Metallurgical	15,754	11,518	9,879	9,870
Breeze, all types	1,164	1,070	972	970
Fuel briquets, all grades	NA	2,679	2,597	NA
Gas:				
Manufactured[7] ... million therms	NA	33	42	NA
Natural:				
Gross ... million cubic feet	NA	1,560,124	1,548,859	[1]1,675,673
Marketed ... do	1,316,358	1,416,041	1,382,315	[1]1,410,285
Natural gas liquids ... thousand 42-gallon barrels	5,721	4,489	3,050	[1]3,468
Petroleum:				
Crude, including field condensate ... do	84,655	278,838	388,538	[1]561,656
Refinery products:				
Gasoline:				
Aviation ... do	2,127	425	329	[1]570
Motor ... do	129,472	149,721	155,950	[1]136,374
Jet fuel ... do	33,304	33,904	38,872	[1]42,584
Kerosine ... do	19,050	20,592	20,166	[1]20,995
Distillate fuel oil ... do	180,517	141,468	175,219	[1]189,850
Residual fuel oil ... do	217,749	152,133	203,250	[1]190,476
Lubricants ... do	9,170	7,319	8,412	[1]9,310
Other ... do	82,987	81,454	75,506	[1]89,225
Refinery fuel and losses ... do	48,737	50,939	48,178	[1]45,766
Total ... do	723,113	637,955	725,882	[1]725,150

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] Reported figure.

[2] Includes wheels, centers, tires, axles, and semimanufactures for immediate sale.

[3] From imported bullion, including Pb content of alloys produced.

[4] From scrap materials. Series revised to comprise all secondary output including Pb content of secondary antimonial lead and to exclude output from domestic ores.

[5] Excludes plasters.

[6] Consists of brick, retorts, molds, and other refractory products made from clays, silica, silicious materials, magnesite, alumina, and chrome materials.

[7] Gas made at gasworks plus purchased coke oven refinery gas.

TRADE

Total imports of the United Kingdom in 1978 were valued at £36.6 billion, and were estimated at £40 billion in 1979. Basic materials, including ores and concentrates, accounted for £3.4 billion in imports in 1978; another £4.8 billion in imports were fuels, largely petroleum products. Total exports amounted to £35.4 billion in 1978, including £1.0 billion in exports of basic materials and £2.4 billion in fuels exports. In 1979, the total value of exports was estimated at £39 billion.

Trade with the United States in mineral-related products in 1977 was heavily in favor of the United Kingdom. The approximately $393 million worth of U.S. exports to the United Kingdom was equal to only about a quarter of U.S. minerals-related imports from the United Kingdom, which were valued at $1.43 billion. U.S. exports were chiefly nonferrous metals, coal and coke, and lubricants. Major U.S. minerals imports from the United Kingdom were petroleum products, iron and steel, semifabricated products, and reexports of diamonds and radioactive materials.

The minerals trade of the United Kingdom in 1977 and 1978 is given in tables 2 and 3.

Table 2.—United Kingdom: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite and concentrate	463	466	NA.
Oxide and hydroxide	43,360	36,061	Republic of South Africa 3,972; Portugal 3,493.
Metal including alloys:			
Scrap	9,742	12,706	Federal Republic of Germany 6,080; Netherlands 3,173.
Unwrought	145,795	160,515	Netherlands 84,880; Federal Republic of Germany 16,753; United States 16,089.
Semimanufactures	66,970	63,227	Nigeria 6,222; Ireland 6,000; Federal Republic of Germany 5,755.
Antimony metal	700	NA	
Arsenic trioxide, pentoxide, acids	3,890	NA	
Beryllium metal including alloys, all forms	2	7	NA.
Bismuth metal including alloys, all forms	310	NA	
Cadmium metal, including scrap	109	NA	
Chromium:			
Chromite	26	38	NA.
Oxide and hydroxide	(1)	4,638	United States 2,821; France 924.
Metal including alloys, all forms	2,100	NA	
Cobalt:			
Oxide and hydroxide	316	411	Netherlands 96; Federal Republic of Germany 80; Japan 62.
Metal, including matte, speiss, etc	600	NA	
Columbium and tantalum: Tantalum metal including alloys, all forms	24	36	Federal Republic of Germany 24.
Copper:			
Ore and concentrate	2,099	973	NA.
Metal including alloy:			
Scrap	29,177	40,476	Italy 21,065; Federal Republic of Germany 15,355.
Unwrought	47,252	39,873	Federal Republic of Germany 12,218; Italy 5,333; Sweden 4,640.
Semimanufactures	133,589	131,921	Switzerland 18,877; Ireland 11,744.
Gold, unworked or partly worked:			
Bullion, refined ______ thousand troy ounces	21,218	16,596	NA.
Other do	579	3,999	NA.
Iron and steel:			
Ore and concentrate, except roasted pyrite	767	384	NA.
Metal:			
Scrap thousand tons	938	1,565	Spain 777; Federal Republic of Germany 204; Italy 173.
Pig iron, ferroalloys, similar materials do	88	76	Federal Republic of Germany 24; Iran 5; United States 5.
Steel, primary forms do	415	400	United States 132; Italy 76; Federal Republic of Germany 54.
Semimanufactures:			
Bars, rods, angles, shapes, sections:			
Wire rod do	395	477	Venezuela 59; United States 48; Turkey 39.
Other bars and rods do	800	845	United States 118; China, mainland, 89; Federal Republic of Germany 82.
Angles, shapes, sections do	590	479	United States 92; Republic of Korea 40; Ireland 35.

See footnotes at end of table.

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Table 2.—United Kingdom: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Semimanufactures —Continued			
Universals, plates, sheets:			
Universals and heavy plates, uncoated thousand tons	361	NA	
Medium plates and sheets, uncoated do.	86	NA	
Light plates and sheets, uncoated do.	457	NA	
Tinned plates and sheets do.	258	227	India 48; Nigeria 16; Greece 12.
Other coated plates and sheets do.	204	NA	
Unspecified do.	--	948	Federal Republic of Germany 121; Iran 113; India 84; U.S.S.R. 71.
Hoop and strip do.	120	128	Ireland 13; France 10; Federal Republic of Germany 9.
Rails and accessories do.	109	96	Kenya 21; France 13; Egypt 11.
Wire do.	117	71	Canada 22; United States 22.
Tubes, pipes, fittings do.	510	541	Sweden 36; Ireland 29.
Castings and forgings, rough do.	80	95	United States 44; Sweden 10.
Total do.	4,087	3,907	
Lead:			
Ore and concentrate	5,558	6,860	Belgium-Luxembourg 5,669.
Oxides	8,988	6,950	Ireland 2,319; Egypt 701; Federal Republic of Germany 667.
Metal including alloys:			
Scrap	6,874	16,615	Federal Republic of Germany 4,805; Italy 4,592; Ireland 3,001.
Unwrought	126,080	122,126	Federal Republic of Germany 24,932; Netherlands 17,947.
Semimanufactures	3,111	2,292	NA.
Magnesium metal including alloys:			
Scrap	56	330	NA.
Unwrought	714	1,009	United States 314; France 235; Canada 219.
Semimanufactures	388	814	Belgium-Luxembourg 170; India 128.
Manganese:			
Ore and concentrate	6,767	7,169	Italy 1,920; Federal Republic of Germany 1,630; Republic of South Africa 1,597.
Oxides	1,048	1,011	NA.
Mercury 76-pound flasks	1,334	1,479	NA.
Molybdenum metal including alloys, all forms	144	147	France 52.
Nickel:			
Matte, speiss, similar materials	445	265	Sweden 119.
Metal including alloys:			
Scrap	6,575	3,423	Japan 937; Sweden 626; Federal Republic of Germany 621.
Unwrought	26,323	20,412	Federal Republic of Germany 5,290; Belgium-Luxembourg 4,090.
Semimanufactures	10,492	10,070	France 1,886; Federal Republic of Germany 1,194; Sweden 974.
Platinum-group metals and silver:			
Ores and concentrates value, thousands	$830	$2,480	Brazil $1,283; Republic of South Africa $984.
Waste and sweepings do.	$9,768	$7,035	Spain $3,178; Federal Republic of Germany $1,846; France $813.
Metals including alloys:			
Platinum-group thousand troy ounces	1,157	1,286	United States 321; Japan 225; Federal Republic of Germany 192.
Silver:			
Refined do.	53,531	15,207	France 3,665; Sweden 2,025; Italy 1,704.
Other do.	675	675	NA.
Tin:			
Ore and concentrate	180	3,608	Belgium-Luxembourg 1,095; Spain 915; Federal Republic of Germany 617.
Oxides	504	8,746	United States 2,349; Canada 834; Netherlands 809.
Metal including alloys:			
Scrap	212	153	NA.
Unwrought	8,734	8,500	U.S.S.R. 4,239; Netherlands 1,135.
Semimanufactures	1,008	350	Norway 69; Sweden 58.
Titanium oxides	9,852	12,763	Hungary 1,474; Poland 1,301; Japan 1,112.

See footnotes at end of table.

Table 2.—United Kingdom: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Tungsten:			
Ore and concentrate	366	135	Federal Republic of Germany 50; Netherlands 50.
Metal including alloys, all forms	455	358	Federal Republic of Germany 112; Netherlands 102.
Uranium and thorium metals including alloys, all forms kilograms	7,000	7,000	NA.
Zinc:			
Ore and concentrate	9,795	9,443	Italy 4,075; Belgium-Luxembourg 2,895; France 2,461.
Oxide and peroxide	10,610	11,585	Netherlands 1,862; Cuba 1,324; Belgium-Luxembourg 1,146.
Metal including alloys:			
Scrap	3,856	6,018	Federal Republic of Germany 3,890; France 786.
Unwrought	23,769	21,162	Netherlands 4,020; Ireland 3,713; Greece 2,548.
Semimanufactures	3,322	2,198	Sri Lanka 166; Federal Republic of Germany 100.
Other:			
Ores and concentrates:			
Of molybdenum, tantalum, titanium, vanadium, zirconium	4,893	7,690	France 3,206; Federal Republic of Germany 1,022; Netherlands 702.
Of base metals, n.e.s value, thousands	$13	--	
Ash and residue containing nonferrous metals	60,541	49,042	Federal Republic of Germany 20,992; Canada 8,094; Belgium-Luxembourg 7,625.
Oxides, hydroxides, peroxides of metals	238,274	NA	
Metals including alloys, all forms:			
Metalloids, n.e.s	1,487	4,787	China, mainland, 1,629; Malaysia 968; Australia 751; Netherlands 685.
Alkali, alkaline-earth, rare-earth metals	207	238	NA.
Pyrophoric alloys	320	3,829	Federal Republic of Germany 972; Ireland 799; Saudi Arabia 221.
Base metals including alloys, all forms, n.e.s	7,055	6,469	United States 2,350; Federal Republic of Germany 554; France 464.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	2,954	2,763	NA.
Dust and powder of precious and semiprecious stones value, thousands	$2,743	$2,890	Ireland $483; Belgium-Luxembourg $393; Japan $366.
Grinding and polishing wheels and stones	8,800	7,826	Sweden 849; Federal Republic of Germany 696; Poland 674.
Asbestos, crude and waste	705	522	NA.
Barite and witherite	3,904	3,424	NA.
Boric oxide and acid	963	1,280	Netherlands 650.
Cement thousand tons	1,700	1,879	Nigeria 671; United States 373; Togo 273.
Chalk	58,525	60,455	Sweden 10,792; Australia 7,448; Nigeria 6,210.
Clays and clay products (including all refractory brick):			
Crude thousand tons	2,730	2,767	Federal Republic of Germany 434; Italy 427; Finland 335.
Products:			
Refractory (including nonclay brick) do	256	217	Italy 28; Sweden 19; Brazil 10.
Nonrefractory do	157	198	Ireland 38; Netherlands 37.
Cryolite and chiolite	1	15	NA.
Diamond, all grades value, millions	$1,135	$1,310	Switzerland $652; Belgium-Luxembourg $355.
Diatomite and other infusorial earth	1,085	859	NA.
Feldspar and fluorspar	26,220	9,925	Norway 3,109; Federal Republic of Germany 867.
Fertilizer materials:			
Crude:			
Nitrogenous	180	123	NA.
Phosphatic	72	85	NA.
Potassic	--	10	NA.
Other	2,824	3,454	NA.
Manufactured:			
Nitrogenous thousand tons	255	136	Netherlands 35; Belgium-Luxembourg 30.
Phosphatic	49,228	58,184	Ireland 38,479; Bangladesh 14,400.
Potassic	35,068	63,274	Netherlands 31,866; Norway 19,012.
Other, including mixed	539,994	520,530	Ireland 234,396; Turkey 75,599; Federal Republic of Germany 73,025.
Graphite, natural	2,544	2,648	United States 1,703.
Gypsum and plasters	14,767	12,401	Ireland 3,100.

See footnotes at end of table.

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Table 2.—United Kingdom: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS —Continued			
Lime	47,098	40,547	Nigeria 13,786; Venezuela 9,275.
Magnesite	50,260	52,736	Poland 14,759; Federal Republic of Germany 6,671; Venezuela 4,974.
Mica:			
Crude, including splittings and waste	3,589	3,349	Federal Republic of Germany 682.
Worked, including agglomerated splittings	65	244	India 31; United States 10.
Pigments, mineral:			
Natural, crude	6,403	NA	
Iron oxides, processed	9,059	11,721	United States 1,895; Italy 753; Canada 684; France 546.
Precious and semiprecious stones, except diamond:			
Natural value, thousands	$21,751	$18,100	Switzerland $8,967; France $3,702.
Manufactured do	$245	$121	Switzerland $11.
Salt thousand tons	468	405	Sweden 138; Nigeria 74; Ireland 59.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	313,788	50,925	Nigeria 7,495; China, mainland, 5,948; Ireland 4,568.
Caustic potash and sodic and potassic peroxides	895	285	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	12,208	10,411	France 2,970.
Worked	5,349	4,015	Federal Republic of Germany 589.
Dolomite, chiefly refractory grade	3,704	12,079	NA.
Gravel and crushed rock thousand tons	5,177	5,835	Belgium-Luxembourg 2,126; Netherlands 1,812; France 1,427.
Limestone, except dimension	14,288	356,267	Belgium-Luxembourg 130,475.
Quartz and quartzite	1,332	12,876	NA.
Sand, excluding metal bearing	67,875	78,123	Ireland 34,748; Sweden 15,594.
Strontium minerals: Celestite	3,800	NA	
Sulfur:			
Elemental:			
Other than colloidal	1,387	1,422	NA.
Colloidal	211	123	NA.
Sulfur dioxide	110	26,061	Ireland 5,229; United States 4,073.
Sulfuric acid	54,449	159,741	Portugal 55,845; Spain 35,962; Ireland 31,629.
Talc, steatite, soapstone, pyrophyllite	4,348	3,978	Ireland 1,568.
Other:			
Crude	890,824	501,489	Belgium-Luxembourg 144,197; Norway 128,104; Sweden 104,295.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	100,803	126,826	Federal Republic of Germany 111,034.
Slag and ash, n.e.s	4,635	4,674	Sweden 1,490.
Oxides and hydroxides of magnesium, strontium, barium	7,647	570	Federal Republic of Germany 154; Netherlands 112.
Halogens, other than chlorine	2,660	1,958	France 583; Ireland 401; Italy 354.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	147,388	94,345	Nigeria 17,125; Ireland 16,392.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	5,837	4,294	NA.
Carbon black	36,384	35,235	Ireland 6,209; Nigeria 3,595; Federal Republic of Germany 3,511.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	1,941	2,266	France 950; Federal Republic of Germany 494.
Briquets of anthracite and bituminous coal do	157	146	Norway 137.
Lignite and lignite briquets	--	98	NA.
Coke and semicoke thousand tons	679	3,932	NA.
Hydrogen and rare gases	4,083	7,588	Ireland 4,020; Norway 1,632.
Peat, including peat briquets and litter	3,954	2,841	NA.
Petroleum:			
Crude and partly refined:			
Crude thousand 42-gallon barrels	106,756	168,668	Federal Republic of Germany 34,922; United States 30,091.
Partly refined do	1,497	NA	

See footnotes at end of table.

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Table 2.—United Kingdom: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum —Continued			
Refinery products:			
Gasoline, including natural thousand 42-gallon barrels	17,434	18,453	Ireland 5,002; Sweden 2,415; Denmark 1,958.
Kerosine and jet fuel do.	4,852	6,301	Ireland 3,027; Denmark 884.
Distillate fuel oil do.	35,600	37,260	Denmark 9,716; Netherlands 7,859; Sweden 5,514.
Residual fuel oil do.	37,321	25,776	Ireland 7,149; Sweden 6,853.
Lubricants do.	5,050	8,601	France 2,219; Netherlands 1,398.
Other:			
Liquefied petroleum gas do.	5,695	8,661	Portugal 2,009; Spain 1,775; Ireland 1,235.
Mineral jelly and wax do.	254	356	Nigeria 81; Federal Republic of Germany 64.
Nonlubricating oils, n.e.s do.	556	NA	
Bitumen and other residues and bituminous mixtures, n.e.s do.	909	929	Ireland 627; Nigeria 30; Dubai 19.
Pitch, pitch coke, petroleum coke do.	1,963	2,658	NA.
Total do.	109,634	108,995	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	125,520	490,034	Netherlands 291,312; Norway 58,335.

NA Not available.

[1] Value only reported at $1,604,000.

Table 3.—United Kingdom: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate thousand tons	345	321	Ghana 229; Greece 43.
Oxide and hydroxide do.	703	699	Jamaica 511; Surinam 99.
Metal including alloys:			
Scrap do.	6	5	Federal Republic of Germany 1; Netherlands 1.
Unwrought do.	203	191	Norway 128; Iceland 20.
Semimanufactures do.	135	164	Federal Republic of Germany 27; France 21; Belgium-Luxembourg 20.
Arsenic trioxide, pentoxide, acids value, thousands	$582	NA	
Beryllium metal including alloys, all forms	12	10	United States 6.
Bismuth metal including alloys, all forms	394	NA	
Cadmium metal including alloys, all forms	1,298	NA	
Chromium:			
Chromite thousand tons	198	138	Republic of South Africa 110.
Oxide and hydroxide	578	1,033	Federal Republic of Germany 367; Netherlands 269.
Cobalt:			
Oxide and hydroxide	1,096	1,141	Canada 980.
Metal including alloys, all forms	1,100	NA	
Columbium and tantalum: Tantalum metal including alloys, all forms	115	106	United States 77.
Copper:			
Ore and concentrate	1,112	548	Czechoslovakia 495.
Matte[1]	--	1,448	Federal Republic of Germany 1,425.
Metal including alloys:			
Scrap	12,365	9,592	Ireland 1,958; Federal Republic of Germany 1,434; United States 1,040.
Unwrought	443,972	405,000	Zambia 76,972; Chile 74,450; Canada 71,998.
Semimanufactures	43,059	67,067	Federal Republic of Germany 16,469; France 12,308; Sweden 6,755.
Gold bullion:			
Refined thousand troy ounces	20,630	16,342	NA.
Unrefined do.	216	92	NA.
Other do.	11	--	
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	15,539	15,458	Brazil 3,578; Canada 3,124; Australia 1,723; Republic of South Africa 1,573.

See footnotes at end of table.

Table 3.—United Kingdom: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Iron and steel —Continued			
Roasted pyrite thousand tons	212	227	Sweden 181.
Metal:			
Scrap do.	100	458	All from Federal Republic of Germany.
Pig iron, cast iron, sponge, powder, shot do.	180	169	Norway 35; Federal Republic of Germany 34; Brazil 21.
Ferroalloys:			
Ferromanganese do.	86	84	France 13.
Other do.	226	95	Norway 66.
Steel, primary forms do.	912	803	Netherlands 132; Federal Republic of Germany 119.
Semimanufactures:			
Bars, rods, angles, shapes, sections:			
Wire rods do.	167	131	France 28; Federal Republic of Germany 27; Netherlands 19.
Other bars and rods do.	278	345	Sweden 90; Norway 41; Italy 40; Spain 36.
Angles, shapes, sections do.	207	230	Belgium-Luxembourg 48; Republic of South Africa 31.
Universals, plates, sheets:			
Heavy and medium plates and sheets, uncoated do.	567	NA	
Light plates and sheets, uncoated do.	834	NA	
Tinned plates and sheets do.	109	112	Netherlands 60; Norway 15; United States 14.
Other coated plates and sheets do.	200	NA	
Unspecified do.	--	1,698	Federal Republic of Germany 365; Netherlands 221; Belgium-Luxembourg 214.
Hoop and strip do.	87	91	Federal Republic of Germany 28; Belgium-Luxembourg 12.
Rails and accessories do.	1	25	France 22.
Wire do.	35	47	Belgium-Luxembourg 18; Federal Republic of Germany 8.
Tubes, pipes, fittings do.	363	267	Federal Republic of Germany 59; Netherlands 58.
Casting and forgings, rough do.	20	20	France 8; Federal Republic of Germany 4; Portugal 3.
Total do.	2,868	2,966	
Lead:			
Ore and concentrate do.	45	43	Canada 10; Honduras 10; Australia 8.
Oxides	147	371	NA.
Metal including alloys:			
Scrap	7,450	2,618	Ireland 1,160; United States 446.
Unwrought thousand tons	185	199	Australia 144; Canada 39.
Semimanufactures	1,610	1,834	Ireland 912; Netherlands 269.
Magnesium metal including alloys:			
Scrap	733	389	NA.
Unwrought	5,172	5,283	Norway 2,595; Netherlands 1,417; Canada 1,231.
Semimanufactures	222	440	Norway 187.
Manganese:			
Ore and concentrate thousand tons	328	261	Republic of South Africa 121; Brazil 53; Ghana 37.
Oxides	4,764	5,955	Ireland 2,911; Greece 1,560.
Metal	3,900	NA	
Mercury 76-pound flasks	8,789	12,270	Spain 3,858; Netherlands 3,626.
Molybdenum:			
Ore and concentrate	9,820	NA	
Metal including alloys, all forms	162	220	Australia 95; Federal Republic of Germany 51.
Nickel:			
Matte, speiss, similar materials	61,608	31,693	Canada 27,414.
Metal including alloys:			
Scrap	3,488	2,854	United States 611; Netherlands 541; France 454.
Unwrought	21,621	16,807	Canada 8,459; Norway 2,183; Australia 1,908.
Semimanufactures	2,930	3,199	Federal Republic of Germany 1,160; United States 1,002.
Platinum-group metals and silver:			
Ores and concentrates value, thousands	$35,356	$42,828	NA.
Waste and sweepings do.	$22,936	$24,272	NA.
Metals including alloys:			
Platinum-group thousand troy ounces	354	386	Republic of South Africa 193; U.S.S.R. 32; United States 32.

See footnotes at end of table.

Table 3.—United Kingdom: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Platinum-group metals and silver —Continued			
Metals including alloys —Continued			
Silver:			
Refined thousand troy ounces	35,977	4,630	France 1,157; United States 964.
Unrefined do	162	129	NA.
Other do	--	41,989	India 11,220; German Democratic Republic 7,009.
Selenium, elemental	243	NA	
Silicon, elemental	18,781	NA	
Tin:			
Ore and concentrate	45,104	39,105	Bolivia 31,840; Argentina 2,581; Republic of South Africa 2,031.
Metal including alloys:			
Scrap	1,477	1,355	United States 368; Federal R.public Germany 314.
Unwrought and semimanufactures	9,464	8,475	Nigeria 2,557; Malaysia 2,146; Australia 1,577.
Titanium:			
Ore and concentrate thousand tons	3,949	NA	
Oxides do	5	6	Federal Republic of Germany 2; Italy 2.
Metal including alloys, all forms do	6	NA	
Tungsten:			
Ore and concentrate	3,365	3,653	Portugal 765; Netherlands 572; Thailand 429.
Metal including alloys, all forms	208	567	Federal Republic of Germany 259; Republic of Korea 75.
Uranium and thorium:			
Ores and concentrates	--	40	NA.
Metals including alloys, all forms	4	5	NA.
Zinc:			
Ore and concentrate thousand tons	183	160	Peru 34; Ireland 29; Australia 23; Canada 19.
Oxide and peroxide	1,722	3,649	Federal Republic of Germany 1,958; France 956.
Metal including alloys:			
Scrap and blue powder	(3)	1,036	NA.
Unwrought thousand tons	203	189	Canada 47; Netherlands 46; France 39.
Semimanufactures	3,609	1,243	Federal Republic of Germany 1,142.
Zirconium ore and concentrate	33,700	NA	
Other:			
Ores and concentrates of tantalum and vanadium value, thousands	$33,348	$30,518	NA.
Ash and residue containing nonferrous metals	95,959	66,259	United States 11,274; Federal Republic of Germany 9,430.
Oxides, hydroxides, peroxides of metals	187,980	326,826	United States 154,212; Netherlands 109,492.
Metals including alloys, all forms:			
Metalloids, n.e.s value, thousands	$20,086	--	
Alkali, alkaline-earth, rare-earth metals	49	169	United States 20.
Pyrophoric alloys	38	--	
Base metals including alloys, all forms, n.e.s	12,914	15,392	United States 3,369; Austria 2,392; Republic of South Africa 2,001.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	261,166	(4)	NA.
Dust and powder of precious and semiprecious stones value, thousands	$5,811	$5,561	NA.
Grinding and polishing wheels and stones	3,099	3,841	Netherlands 805; Italy 683; Austria 521.
Asbestos thousand tons	127	118	Canada 88; Republic of South Africa 21.
Barite and witherite do	51	80	Netherlands 35; Morocco 18; Ireland 12.
Boron materials:			
Borax	9,200	NA	
Oxide and acid	5,710	7,554	France 3,266; Netherlands 1,988; Turkey 1,922.
Bromine	3,500	NA	
Cement thousand tons	54	107	Ireland 99.
Chalk	1,050	970	NA.
Clays and clay products (including all refractory brick):			
Crude thousand tons	215	186	United States 73; Republic of South Africa 33; Spain 30.
Products:			
Refractory (including nonclay brick)	62,231	52,095	Ireland 17,033; Federal Republic of Germany 6,829.
Nonrefractory	35,333	61,113	Italy 36,627; Federal Republic of Germany 5,666; Spain 4,735.
Cryolite and chiolite	2,822	2,817	Denmark 2,722.
Diamond, all grades value, millions	$1,034	$1,251	NA.
Diatomite and other infusorial earth	(4)	9,090	United States 4,250; Denmark 2,665.
Feldspar and fluorspar thousand tons	187	172	Norway 108; Finland 34; Sweden 14.

See footnotes at end of table.

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Table 3.—United Kingdom: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Fertilizer materials:			
Crude:			
Nitrogenous thousand tons	7	8	Chile 6.
Phosphatic do.	1,827	1,772	Morocco 793; Senegal 413.
Potassic do.	20	23	German Democratic Republic 12; Federal Republic of Germany 11.
Manufactured:			
Nitrogenous do.	467	416	NA.
Phosphatic:			
Thomas (basic) slag	9,933	9,192	Belgium-Luxembourg 8,354.
Other	40,939	8,252	France 3,769.
Potassic thousand tons	740	668	German Democratic Republic 209; Federal Republic of Germany 194.
Other, including mixed do.	216	286	Netherlands 94; Belgium-Luxembourg 50; Ireland 50.
Graphite, natural	18,491	17,166	Norway 7,122; Madagascar 4,892.
Gypsum and plasters thousand tons	87	40	Ireland 33; France 5.
Iodine	1,095	NA	
Lime	2,512	2,723	NA.
Magnesite thousand tons	128	132	Greece 33; Spain 24; Japan 20; Italy 17.
Mica:			
Crude, including splittings and waste	13,156	15,337	China, mainland, 4,111; Republic of South Africa 1,839.
Worked, including agglomerated splittings	407	436	Belgium-Luxembourg 151; Federal Republic of Germany 132.
Pigments, mineral:			
Natural, crude	5,659	NA	
Iron oxides, processed	23,917	24,906	Federal Republic of Germany 20,109.
Precious and semiprecious stones, except diamond:			
Natural value, thousands	$22,777	$19,867	Switzerland $7,745; United States $2,484.
Manufactured do.	$348	$154	United States $110.
Pyrite, gross weight thousand tons	20	--	
Salt and brine do.	85	236	Italy 192; Federal Republic of Germany 21; Netherlands 20.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	35,538	5,181	NA.
Caustic potash and sodic and potassic peroxides	3,555	3,608	France 1,193; Federal Republic of Germany 701.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	12,981	12,604	Italy 10,094.
Slate	1,309	718	NA.
Other	13,355	16,179	Republic of South Africa 4,849; India 3,070; Sweden 2,511.
Worked:			
Slate	2,641	2,544	Spain 1,474.
Paving stone and flagstone	12,383	14,775	Portugal 14,264.
Other	13,437	14,497	Italy 8,170.
Dolomite, chiefly refractory grade	52,347	95,209	Spain 80,400; Norway 12,383.
Gravel and crushed rock thousand tons	191	149	Ireland 83; Italy 22; Norway 22.
Limestone, except dimension	5,677	3,141	NA.
Quartz and quartzite	4,550	3,865	United States 620.
Sand, excluding metal bearing thousand tons	90	83	Belgium-Luxembourg 69.
Sulfur:			
Elemental:			
Other than colloidal do.	1,110	1,134	Poland 419; France 287; Canada 145.
Colloidal	451	561	NA.
Sulfuric acid thousand tons	127	66	Norway 32; Finland 8; Federal Republic of Germany 8.
Talc, steatite, soapstone, pyrophyllite	60,572	62,473	Norway 16,282; France 9,953; Italy 9,857; China, mainland, 8,744.
Other:			
Crude:			
Meerschaum, amber, jet	30,128	NA	
Other thousand tons	376	NA	
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	79,419	95,643	Canada 31,214; Republic of South Africa 30,190.
Slag and ash, n.e.s	11,965	8,212	Netherlands 6,378; Argentina 1,094.
Oxides and hydroxides of magnesium, strontium, barium	45,308	1,504	United States 375; Italy 350.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	41,575	49,133	Belgium-Luxembourg 29,706; Ireland 8,732.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	16,592	17,889	Trinidad and Tobago 6,602; United States 2,260.
Carbon black and gas carbon:			
Carbon black	10,708	71,127	Canada 35,221; Norway 11,863; France 7,672.
Gas carbon	--	14,937	Federal Republic of Germany 12,395.

See footnotes at end of table.

Table 3.—United Kingdom: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS — Continued			
Coal and briquets:			
Anthracite and bituminous coal _ thousand tons	2,414	2,352	Australia 1,028; United States 421; Poland 414.
Briquets of anthracite and bituminous coal do	85	77	France 54; Federal Republic of Germany 22.
Lignite and lignite briquets	109	--	
Coke and semicoke	9,112	223	NA.
Hydrogen and rare gases	[illegible]	2,917	Netherlands 627; United States 618.
Peat, including peat briquets and litter thousand tons	152	158	Ireland 141; U.S.S.R. 13.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	507,681	492,759	Saudi Arabia 103,197; Kuwait 81,962.
Refinery products:			
Gasoline, including natural do	40,994	49,012	Italy 12,196; Netherlands 9,923; U.S.S.R. 7,458.
Kerosine and jet fuel do	9,469	5,069	Netherlands 1,808; Belgium-Luxembourg 606; Italy 558.
Distillate fuel oil do	16,602	12,744	U.S.S.R. 5,222; Netherlands 2,410.
Residual fuel oil do	32,713	27,092	Netherlands 11,937; Belgium-Luxembourg 4,577; Italy 2,918.
Lubricants do	2,641	11,954	Belgium-Luxembourg 4,653; Denmark 1,942; Netherlands 1,800.
Other:			
Liquefied petroleum gas do	15,818	41,971	Norway 32,960; Algeria 6,203.
Mineral jelly and wax do	295	274	Netherlands 213.
Nonlubricating oils, n.e.s do	147	NA	
Bitumen and other residues and bituminous mixtures, n.e.s do	1,045	1,273	United States 682; France 341; Canada 3.
Pitch, pitch coke, petroleum coke do	1,555	1,851	United States 1,273; Netherlands 394; Federal Republic of Germany 25.
Total do	121,279	151,240	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	259,333	342,861	United States 106,750; Netherlands 92,797; France 64,753.

NA Not available.

[1] Includes cement copper.

[2] Value only reported at $582,000; the 1978 value was reported at $97,000.

[3] Value only reported at $2,366; the 1977 value was reported at $1,665.

[4] Value only reported at $681,000; the 1978 value was reported at $610,000.

COMMODITY REVIEW

METALS

Aluminum.—Prospects of an expanding aluminum market in the 1980's caused the three major British producers to consider expansion. The major obstacles were considered to be the high cost of electricity and the reluctance of the British Government to authorize subsidized lower rates.

Anglesey Aluminium Ltd., at Holyhead, Wales, a joint subsidiary of Kaiser Aluminum Co. of the United States (66.7%) and Rio Tinto Zinc Ltd. (33.3%), had sought to double its capacity of 100,000 tons per year at a cost of £150 million. However, the Central Electricity Generating Board (CEGB), a Government entity, refused to negotiate a contract for new supplies at a rate as advantageous as in the original contract, which was tied to the costs of nuclear generation, and Anglesey abandoned its plans early in 1979. It was reported that the CEGB had lost over £200 million under the original contract.

The British Aluminium Co. Ltd. (BA), also abandoned plans to expand its 100,000-ton-per-year smelter at Invergordon, Scotland, because cheap electricity was not available. BA concentrated on expanding its small plants at Lochaber, Fort William (at a cost of £20 million), and at Kinlochleven, also in Scotland. The Lochaber plant was scheduled to be expanded from its capacity of 28,000 tons to 37,000 tons per year by late 1981 at a cost of about £35 million. It was anticipated that the expansion would also permit a reduction in the work force from 518 to 337 persons.

BA reverted to its original U.K.-owned status when Reynolds Metal Co. of the

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United States sold its interests in both BA and Reynolds Tube Investments Aluminum Ltd. (RTIA) in September 1978 for an estimated $86 million. Reynolds had owned 45.9% of BA directly and 2.45% through RTIA. Reynolds declared that it intended to use the proceeds for investment in the U.S. industry; it had held the interest in BA since 1959. After the sale, 58% of BA belonged to Tube Investments Ltd., the former partner of Reynolds, and the remaining shares went to over 100 institutions, mostly in the United Kingdom, none of which held more than 5%.

The third large U.K. aluminum producer, Alcan (U.K.) Ltd.'s 120,000-ton-per-year smelter at Lynemouth, Northumberland (owned 100% by Alcan Canada), produced its own electricity from coal bought from a neighboring coal mine at favorable rates. Alcan's plans for expansion of this smelter depended on continuation of this cheap coal.

The Aluminum Co. of America (Alcoa) opened a new aluminum rolling mill complex at Swansea, Wales, on July 21, 1978. Built at a cost of £40 million, with a capacity of 50,000 to 60,000 tons per year, the mill represented the largest single investment by Alcoa in Europe. It was designed specifically for the production of rigid container sheet for beverage cans.

The London Metal Exchange on August 22, 1978, announced the establishment of an aluminum futures contract, and trading started on October 2, 1978. The action was viewed as a move away from the producer price, which has been set mainly by large North American producers.

Copper.—Commonwealth Smelting Ltd. decided to build a £5 million processing plant to process the copper dross that arises from its zinc smelting operations at Avonmouth. The company planned to use leaching and electrolysis to recover the copper, and plans to treat the remaining lead sludge in a rotary furnace to produce bullion. The plant was scheduled to be completed by the mid-1980's.

BICC Metals Ltd. was constructing a new refinery at Prescot, near Liverpool, to replace its older plants. A shaft furnace, a reverberating furnace, and a tankhouse with a capacity of 55,000 tons per year, were planned to be integrated with a continuous casting and rolling unit installed in 1976. Completion was expected in 1979.

Elkington Copper Refiners Ltd., at Walsall, near Birmingham, was hit with a wildcat strike that reduced production in midyear. Elkington, a subsidiary of Brandeis Goldschmidt of London, had been refining only secondary copper for at least 2 years. Its production capacity was about 25,000 tons per year of cathodes.

Iron and Steel.—In March 1978, the Secretary of State for Industry issued a White Paper entitled "British Steel Corporation: The Road to Viability," which addressed the very difficult problem of the enormous and continuing financial losses of the British Steel Corp. (BSC). In the financial year ending that March, BSC's losses were £433 million, which was somewhat smaller than had been expected, but still equivalent to about £25 per ton for each of the 17.4 million tons produced. In relation to employment, the loss was £2,250 for each of BSC's 197,100 employees. All six divisions of BSC lost money, but the largest, the Welsh division, (5 million tons per year), also lost the largest amount, £173 million. In the following fiscal year BSC's loss was equivalent to about £300 million, and a loss of £330 million was projected for the year to March 1980.

The White Paper in effect abandoned the 10-year strategy to which BSC had been committed since 1973. Emphasis was to be placed on efficiency and product quality, rather than expansion of capacity, but there was to be no formal blueprint. According to the White Paper, however, the two major projects at Redcar, in North Yorkshire, and Ravenscraig, near Motherwell, Scotland, which were too far along for termination to be considered, would be completed. Also, a doubling of stainless steel capacity to 400,000 tons of ingot and 200,000 tons of flat-rolled stainless steel was completed in July 1978, chiefly at the Tinsley Park and Shepcote Lane plants in Sheffield. Construction of electric arc furnaces at the Selton plant near Stoke-on-Trent and at Hunterston and Ravenscraig in Scotland was deferred indefinitely. Also deferred indefinitely were two major planned expansions at Port Talbot, Wales, where £385 million had been slated for raising capacity from 3 million tons to 6 million tons per year, and at Teesside, where construction of a £250 million plate mill had been scheduled with a capacity of 1 million tons per year. The two direct-reduction plants being built at Hunterston, Scotland, were to be mothballed when completed in 1979. Five large steelmaking plants were concurrently closed; they were Clyde Iron, near Glasgow; Hartlepool (Teesside); East Moors, at Cardiff; Ebbw Vale, in Wales; and Shelton, at Stoke-on-Trent. These closings reduced BSC's employment rolls by about 17,000 workers, to a total of 189,000, including

164,500 workers actively engaged in iron and steelmaking. Furthermore, 5,000 more jobs were scheduled to be abolished later in 1979. BSC's capacity was reduced to about 22 million tons per year, but was expected to increase by about 5.5 million tons when Ravenscraig and Redcar come onstream. (This increase could be diminished, however, by any additional negotiated closures of Beswick plants.) It was expected that actual production would be only about 17 million tons in the 1978-79 financial year, the lowest since nationalization of the industry in 1967.

As 1979 progressed, it became apparent that the long-term demand for steel in the United Kingdom would probably settle at around 15 million tons per year, or about half the amount projected by optimistic predictions of only a few years before. Closures were therefore planned to cut capacity to this figure, and it was expected that employment would be further reduced by over 50,000, to a total of 100,000 steelmaking employees. The new facilities completed in the 1972-78 period were all built to take advantage of the economies of scale, and this meant that additional smaller plants would have to be closed. Consett Works in County Duram and the Hallside Works in Scotland were both scheduled to be closed, resulting in the loss of 4,000 and 600 jobs, respectively. A number of rolling mills around Britain were scheduled to be shut down, as were parts of the Scunthorpe works and the Lincolnshire works. But the hardest hit area was expected to be South Wales, where a choice was anticipated between closing either Port Talbot or Llanwern, or a partial closure of each, to scale down production in the area from 5 million tons per year to 3 million tons per year.

In a booklet sent to all members of Parliament, the BSC in April 1978 outlined its needs for continued Government assistance. These needs included financing for new plants required to merely maintain BSC's position in the market and financing to cover expected losses for the next few years. An annual investment program for the BSC, originally set at £2 billion, was scaled down to £1 billion earlier in 1978, but was then further limited to a replacement-only level of £350 to £450 million a year. BSC included 14 major projects in the program, of which Redcar, South Teesside, and Ravenscraig were the longest. These 14 projects would account for the £1 billion available under the program for capital investment up to 1980, and about 38 smaller schemes would call for additional £110 million.

The House of Commons Select Committee on Nationalized Industries produced a report that made numerous suggestions for improving the operations of the BSC, suggesting in particular improvement in relations between the Government and the BSC. The suggestions were chiefly procedural or administrative in nature, and the committee received a cool response from the Government in the form of another White Paper. The Government's White Paper suggested that any such reforms would be of only marginal value.

Tin.—Because of two mine closures, production of tin in Cornwall in 1978 and 1979 was 30% to 40% less than the 1977 total of 3,851 tons. The industry directly employed about 1,000 workers.

In April 1978, the Mount Wellington mine was shut down by the operator, Cornwall Tin and Mining Ltd., a conglomerate of U.S., Canadian, and Swiss interests. The mine's output tonnage and product grade had both been substantially below expectations, and severe water inflow problems had been encountered at the mine. The closure, which cost 320 jobs, came only 18 months after the start of operations. In the last full year of operation, the mine produced 420 tons of tin in concentrates from 144,500 tons of ore, compared with a nominal annual capacity of 200,000 tons of ore. A few weeks after the Mount Wellington mine closed, the neighboring Wheal Jane mine of Consolidated Gold Fields Ltd. was forced to close because of increased pumping costs that resulted from the closing of the Mount Wellington mine. The closing of the Wheal Jane mine, however, also followed long-term unsatisfactory mining results. If this shutdown became permanent, it would cost another 418 jobs. The Government, however, temporarily assumed the cost of pumping the two closed mines to keep them from flooding. The Wheal Jane mine produced about 750 tons of tin in concentrates in 1977, compared with about 1,000 tons in the previous year. In December 1978, the London consultants Mackay & Schnellman issued a report of an examination of the Wheal Jane mine on behalf of a prospective purchaser. Measured ore reserves were given as 192,470 tons grading 0.86% tin, 4.87% zinc, and 0.26% copper; and indicated reserves were put at 509,068 tons grading 0.89% tin, 6.03% zinc, and 0.3% copper. In addition, the mine's inferred reserves were estimated at 2.725 million tons.

In mid-1979, the Rio Tinto Zinc Corp.

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(RTZ) announced that it would reopen the Wheal Jane and Mount Wellington mines as a unit, without a Government subsidy, through its subsidiary, Carnon Consolidated Tin Mines Ltd. (95% owned by RTZ). RTZ estimated that the cost of restoring production by January 1981 would be about £8.5 million (about $20 million), including the cost of purchasing the assets of the former owners. Under RTZ's plan, concentrates from the operation would be smelted by RTZ's Capper Pass smelter at North Ferriby, Yorkshire, which normally handles about 11,000 tons per year of low-grade tin concentrates, including material from Bolivia and Cornwall. The Mount Wellington concentrator at Bissoe was taken over by Billiton (UK) Ltd. to be used chiefly for processing material from old tailings dumps.

The two remaining major tin mining companies at the end of 1978 reported relatively good results for the financial years that ended in March of 1978 and 1979, due to the increased price of tin. Geevor Tin Mines Ltd., operator of the 60-year old Pendeen mine at Pendeen, was due to complete its subincline extension in 1978-79 and was planning a major expansion of its mill. In the financial year that ended in March 1979, the mine treated 119,088 tons of ore, producing 1,052 tons of 65% tin concentrate. Ore reserves as of March 31, 1979, were 379,320 tons grading 1.2% tin oxide, with a recoverable metal content of about 3,000 tons. St. Piran Ltd., at South Crofty and at its smaller Wheal Pendarves mine, both near Camborne, produced a total of 1,548 tons of tin in concentrate in the financial year to March 1979. Ore reserves were reported to have increased somewhat above the 1977 total for both mines, which at that time included 317,834 tons of measured reserves, 676,765 tons of indicated reserves, and 1.25 million tons of inferred reserves. About £1.88 million was being spent at the South Crofty mine to sink a subincline from the 380 fathom level to the 400-fathom level by 1981, in order to develop additional ore.

Marine Mining (Cornwall) Ltd. received a license from the Crown Commissioners to dredge for tin in two areas along the northwest coast of Cornwall over a period of 21 years. The main zones of interest were a 36-square-kilometer area off St. Agnes and a 23-square-kilometer area in St. Ives Bay.

Tungsten.—Initial exploration by Amax Exploration (U.K.) Ltd. on the Hemerdon Ball tungsten deposit near Hemerdon, east of Plymouth, indicated there was about 20 million tons of ore to depths of 330 feet below the surface. This led to a contract to test-drill some 5,000 meters to depths of 600 feet. Late in 1978, it was announced that results were sufficiently favorable for Amax to start a 3-year feasibility study involving exploratory drilling, bulk sampling, and financial marketing studies. A pilot plant may also be built. The survey was being done in conjunction with the owner of the property, Hemerdon Mining and Smelting Ltd., of Bermuda, and it was estimated that the survey would cost Amax about £1.5 million. By agreement, the work, if completed, would earn Amax a 50% interest in the mine. In mid-1979, Amax announced that its estimate of the Hemerdon Ball ore reserves had been increased to about 45 million tons of ore grading 0.17% tungsten trioxide and 0.025% tin and extending to 200 meters below the surface. A pilot plant to process 120 tons of ore per day was scheduled to be commissioned in March 1980. If the pilot plant is successful, plans called for a full-scale plant to treat 2,500 tons of ore per day; the full-scale plant would be started in 1983 and completed in 1985. Amax and Hemerdon also entered into an agreement to conduct exploration on adjoining property owned by English China Clays Ltd. Hemerdon officials, however, were involved in a dispute in Ontario, Canada, over company finances.

The small tungsten production of the United Kingdom in 1978 and 1979 came chiefly from the Carrock Fell mine, near Penrith, Cumbria. The 50% share of Carrock Fell held by Amalgamated Industrials Ltd. was sold in 1978 to NCC Minerals Ltd., a subsidiary of National Carbonising Ltd.

NONMETALS

Barite.—Dresser Minerals International Inc. acquired the 3-year exploration rights on 2,500 acres of Forestry Commission land near Pitlochry, Scotland. The zone targeted for exploration, near Loch Tummel, was 7 kilometers long, up to 50 meters thick, and extended 100 meters below the surface. It contains barium, zinc, and lead mineralization.

There were two major sources of barite in the United Kingdom in 1979. These were Athole G. Allen Ltd., which operated the

Closehouse mine near Lunedale in the North Riding of Yorkshire, and Horace Taylor (Minerals) Ltd., which worked a mine at Silverband, northeast of Appleby in Cumbria. The capacity of the Closehouse mine was 16,000 tons per per year of concentrate, and the Silverband mine was producing 12,000 to 15,000 tons of concentrates per year. Additional smaller producers were Laporte Industries Ltd., at its Glebe fluorspar mine near Eyam, Derbyshire; and Bleaklow Mining Co. Ltd., near Bakewell, Derbyshire. Another producer in the future may be Force Crag Mines (U.K.) Ltd., a prospective lead-zinc producer, in the Lake District of Cumbria.

Bentonite.—A prospective leading producer of bentonite was developing reserves and completing a plant to produce sodium-exchanged bentonite. Brett Bentonite Ltd., a subsidiary of Robert Brett & Sons Ltd., was granted permission to exploit a deposit at Baulking, Oxfordshire, in October 1976. Production was expected to start in the spring of 1979.

The two major bentonite producers in 1978-79 were Laporte Industries Ltd., with mines near Redhill, south of London, and Bath (underground) and Maidstone in Kent; and Berk Ltd., a subsidiary of the Steetley Co. Ltd., which operated a mine at Woburn, Bedfordshire, and a plant at Middlesbrough that processed chiefly imported clays. Permission was granted to Steetley to extend mining to a new site near Woburn.

Fluorspar.—The £2.5 million fluorspar processing plant that was being built for Swiss Aluminum Mining (U.K.) Ltd. (SAMUK) at the Broadwood Quarry, Frosterley, County Durham, was finished 4 months ahead of schedule and was opened officially in November 1978. The plant was expected to produce 50,000 to 100,000 tons of products, the grade of which will depend on the feed. It was expected that the feed would include dump ores and high-grade ore. SAMUK operates five small mines in the vicinity and, in addition to their output was also planning to treat waste dumps of nearby abandoned lead mines. SAMUK was also reported ready to shut down the old Rookhope plant, which it purchased from ICI Ltd. in 1977, in order to concentrate its efforts on the much larger plant at the Broadwood Quarry.

In order to supply its Ryder Point flotation plant near Matlock, Derbyshire, Dresser Minerals International Inc. applied for permission to mine fluorspar near Youlgreave, in the same vicinity, in the Peak District National Park. After Dresser agreed to post a bond covering future restoration of the land, permission was granted by the park board. It was estimated that when the mine and mill are at full capacity, output would be about 100,000 tons per year of acid-grade fluorspar, of which it was expected a sizable portion would be exported.

Gypsum.—The United Kingdom's largest gypsum producer, British Gypsum Ltd., dominated the domestic market, producing all but a very small part of the total production. The company had mines near Kirkby Thore, Cumbria; Sherburn-in-Elmet, east of Leeds; Fauld, northwest of Burton-on-Trent; East Leake (which was the main producing area) and Newark, in Nottinghamshire; and Robertsbridge, in East Sussex. Most deposits are worked underground, and most pass into anhydrite at relatively shallow depths.

Potash.—The mine at Boulby, Cleveland, incorporated as the Cleveland Potash Co. Ltd., required some £16 million of additional financing in the financial year to June 1978. This brought total financing for the mine presumably to about £121 million, including operating costs of £40 million since startup in 1973 and 1974; and there were reports of further requirements of £18 million. Production had still not reached the planned goal of 1 million tons of product (or 600,000 tons of K_2O). At yearend 1978, production was in the neighborhood of only 30,000 tons of product per month, but improvement was evident during 1979. The same problems that had plagued the mine since startup continued, in spite of a switch from conventional room-and-pillar mining to continuous mining with two Jeffrey Heliminers. These problems were the uneven and undulating nature of the seam, gas pockets, poor roof conditions, a higher insoluble content than was forecast, and high working temperatures. Charter Consolidated Ltd., the operator, defended itself from criticism that the 15 preliminary boreholes it had sunk were inadequate by asserting that the conditions could not have been discovered even with twice that number of boreholes.

In October 1979, Imperial Chemical Industries Ltd. (ICI) withdrew from its 50% participation in Cleveland Potash, leaving Charter Consolidated and the Anglo-American Corp. Ltd. as sole owners. A review of operations late in 1979 led to a statement by Charter Consolidated early in 1980 that it had decided to continue operations indefinitely, with no further review.

MINERAL FUELS

Coal.—Early in 1979, the National Coal Board (NCB) and the National Union of

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Mineworkers (NUM) agreed on an incentive bonus scheme to improve productivity. Under local option, miners could earn upwards of £23.50 per week above their basic pay, raising total pay in some cases close to £135 per week, a figure unions had demanded in earlier negotiating rounds that had led to a 10% increase in base pay in February. Productivity, in terms of output per worker shift, thereafter increased only marginally. However, 4-year decline in output per worker shift was reversed, and in 1978 this output increased by an estimated 3.2%; counting only workers at the coal face, the increase was 12.1% by one reckoning. Overall output per worker shift in U.K. deep coal mines in 1978 was 2.2 tons (or 434 tons per year for about 200 shifts).

Production in 1978 was believed to have been about 1 million tons higher than it would have been without the incentives. This improvement came, however, at a time when the BSC, operating in a slack market, was forced to cut its coal purchases back by 3.5 million tons, to a total of 8.2 million tons for the year and total coking coal sales for the year fell to 14.5 million tons from their normal range of 17 to 18 million. The Central Electricity Generating Board, the nation's largest coal customer, however, agreed to increase purchases from 68 million in 1977 to 73 million in 1978, but presumably was forced to stockpile much of the increase. In addition, the coal industry was facing stiffer competition from the rapidly expanding hydrocarbon producers in the North Sea and from producers of low-priced natural gas in particular.

The NCB showed a profit of £74.7 million in the 1977-78 financial year, but the figure was deceiving. The underground mines suffered a loss of £13.4 million, while the opencast mines, which were all operated for the NCB by private contractors, showed a profit of £88.1 million. Nevertheless, opencast mining in the United Kingdom accounts for only about 11% of the total coal mined, which is a smaller proportion than that of any other major coal-producing country. In 1979, there were about 223 underground mines and 57 surface coal mines in operation, producing about 119 million tons of coal annually, of which about 105 million tons came from underground.

The NCB's underground mine results in South Wales were again disastrous; the 37 mines of this group (out of 238 coal mines nationwide) lost £31.8 million, leading to renewed suggestions that the area be abandoned. Abandonment of these mines was considered unlikely, however, because of the unemployment it would cause, but a tripartite committee including members from the Government, the NCB, and the NUM was looking into the problem.

For the 1978-79 financial year, a loss on nationwide underground mining was expected in the range of £50 to £100 million, even after Government grants of £124 million. It was believed that future prospective losses could only be avoided by price increases (which would make coal less competitive with oil and gas), the selective closing of pits (in 1979, four or five were already earmarked for closing), increased productivity (which might be further improved through the incentive scheme) or additional Government subsidies.

Surface mining of coal was expected to be increased by 50% under the 1974 Plan for Coal, from an annual level of 10 million tons in the early 1970's to 15 million in the early 1980's. By the middle of 1979, surface coal output had reached the rate of 13.5 million tons, and it appeared the goal would be reached. The 1978 updated Plan for Coal, "Coal for the Future," noted various problems in surface mining, including its volatile production record, which was due to the relative ease of expanding, and especially cutting back, production; the distrust with which surface mining is viewed by underground miners, who consider it a threat to their livelihood; and its conflict with environmental considerations in heavily populated areas. The Plan for Coal assumed that 20 million tons annually would be the maximum possible surface production in the United Kingdom by the year 2000, given all these constraints.

About 25 major contractors were on the NCB's list of approved strip miners. Most of these were active at some 60 sites, with operations ranging in size from 40,000 to several million tons of production per year. The largest site was at Butterwell, in Northumberland, and was operated by Taylor Woodrow Ltd. Others among the largest contractors were Costain Mining Ltd., Derek Crouch Ltd., Murphy Bros. Ltd., Shand Mining Ltd., and Shepherd Hill Ltd. Strip mines were generally between 100 and 200 feet deep. The deepest mine was the Westfield site in Fife, Scotland, which is over 600 feet deep. The average stripping ratio (the amount of waste removed to coal removed) in the U.K.'s opencast mines was 16 to 1.

Following the revelation in 1977 that coal had been found in drilling for oil in the

North Sea, the NCB announced early in 1979 that it had located extensive reserves 2 miles offshore in the estuary of the River Dee, in North Wales. It may be possible to work these reserves through tunnels from the Point of Ayr colliery nearby. In Scotland, work started on a £37 million project to mine a total of 50 million tons of recoverable reserves under Musselburgh Bay, near Edinburgh, by tunnelling 2.5 miles north from the Monktonhall coal mine. This project, the largest coal project ever undertaken in Scotland, was scheduled to be operable in 1986 and was expected to provide employment for 500 persons.

A third major project, the Park New mine, was well underway at yearend. Potentially, its production would rank only behind that of the Selby (10 million tons per year) and Vale of Belvoir (7 million tons per year) projects. These three projects were major components in the ongoing Plan for Coal, initiated in 1974, which provided for investments of about £500 million annually for new coal facilities. The Park New mine, located north of Stafford, between the villages of Hopton and Salt, was planned to be developed by the NCB to produce over 2 million tons of coal annually by 1987 or 1988 from up to 10 workable seams. Interest in the project was high because productivity, an important consideration in the United Kingdom, was expected to be three times the national average of 2.2 tons per worker shift.

Full output at Selby was expected by 1987 or 1988. A contract for the surface plant at nearby Wistow was let. It was reported that underground recovery at Selby would amount to only about 20% of the coal in place there because of the danger of flooding of the low-lying surface, which is below sea level at high tide. A first loan from the European Commission, amounting to £65 million, was approved to cover the Selby project's capital expenditures up to March 31, 1980.

Planning continued on the North East Leicestershire project in the Vale of Belvoir, which was expected to include three mines, near Hose, Saltby, and Asfordby, that would yield 7 million tons annually by the mid or late 1980's.

The Betwys anthracite mine near Ammanford, north of Swansea in Wales, was opened on schedule in mid-1979, with a capacity of 500,000 tons of anthracite produced per year. The Welsh anthracite field, which stretches northwest from Glyn-Neath for 25 miles, is the only source of anthracite in the United Kingdom. Its production had declined in the previous 5 years from about 3 million tons per year to 2 million tons per year because of declining productivity and increasing costs. The Betwys colliery was expected to slow or reverse this trend because it was projected that productivity there would be 5 tons per worker shift, compared with the national average of 2.2 tons per worker shift and the South Wales coalfield average of 1.3 tons per worker shift. Of the coal mined in the Welsh anthracite field, half was mined from the surface, and half was mined underground.

Natural Gas.—Gas Gathering Pipelines (North Sea) Ltd., the company formed in 1977 to study the viability of gas-gathering pipeline systems in the Northern Basin of the North Sea, submitted its final report in March 1978. It concluded that information available at that time indicated no immediate need for a new gas trunk pipeline to shore and that gas should accordingly be accommodated in the existing trunk lines from the Brent and Frigg fields. However, the report admitted uncertainty with regard to these conclusions and recommended a continued review.

The Morecambe gasfield in the Irish Sea, northwest of Liverpool, was planned to be developed by the British Gas Corp. (BGC) by the mid-1980's. The field was discovered in 1974 by the BGC, the State gas monopoly, and after further successful drilling in 1978, was estimated to contain 2 trillion to 3 trillion cubic feet of gas.

An estimated 25% of the supplies purchased by the BGC was associated gas from the country's northern oilfields. According to the BGC, average prices to consumers were expected to rise above those for more easily accessible southern gas; the wellhead price for northern gas paid by the BGC was 10 pence per therm (about 100 cubic feet), compared with 1.9 pence per therm for southern gas. It was claimed that future development of more marginal fields, such as South Indefatigable and Sole Pit, would require prices near the 10-pence level.

At the end of 1979, the BGC announced price increases of 20% for domestic consumers and 10% for industrial and commercial users, to be phased in beginning April 1 and October 1. This attempt to bring gas prices more in line with the cost of other fuels was a controversial move, since the BGC's pre-tax profits in the 1979 fiscal year were £361 million on £3.0 billion in sales, and since profits could in a few years exceed

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£1 billion.

Petroleum.—Crude oil production, largely from North Sea offshore fields, reached only about 380 million barrels in 1978, as opposed to forecasts early in the year that it would be in the range of 450 million to 500 million barrels. In 1979, production reached 560 million barrels. Labor disputes, bad weather in the North Sea, accidents, Government policy decisions, and technical difficulties all played a part in the failure to reach expected levels. Later in the year, a consensus of a feeling of lesser urgency seemed to be developing, according to which the United Kingdom would perhaps be better off if production were permitted to reach, by the mid-1980's, only a level somewhat above self-sufficiency (2 million barrels per day, or 100 million tons per year). A lighter production level at a 3-million-barrel-per-day level would permit substantial exports and foreign exchange earnings but deplete unrenewable resources at a slower rate. At yearend, however, no change in the country's depletion policy had been announced.

In October 1978, revised estimates of the impact of North Sea oil and gas on the gross national product (GNP) and balance of payments were issued by the U.K. Treasury. Assuming a peak production of 125 million tons per year (2.5 million barrels per day) in 1985, the annual benefit of oil and gas output to the GNP would rise to £6.6 billion in 1985, versus earlier estimates of £5.9 billion. The benefit to the balance of payments in the same year was revised upwards from £7.9 billion to £8.5 billion.

By the closing date in November 1978, 55 applications, reportedly involving about 100 companies, had been received by the British Government for the 40 oil exploration blocks on offer in the Sixth Round of Licensing. This was the smallest number of blocks ever offered; it compared with 71 blocks in the Fifth Round in 1977 and several hundred in each of the previous rounds. Most of the acreage offered was in the southwestern approaches (southwest of Cornwall) and north of the Shetland Islands. Six additional blocks were awarded noncompetitively to the British National Oil Corp. (BNOC), the State-owned oil company. By spring 1979, conditional awards were made on 42 of the 46 blocks, involving [illegible] companies.

The conditions attached to the licensing by the Government, which were described as an attempt to strengthen British control over offshore resources, gave rise to some fears that the industry's desire to bid might be adversely affected. Exxon in fact did not bid, and Shell's bid was limited. Under the license conditions, the BNOC would receive at least 51% of the equity, as in the Fifth Round, but in addition, bidders would be allowed to offer the BNOC the right to purchase more than 51%. Also, companies must offer to carry the BNOC free in the exploration stage, and the exploration and production phases would be awarded separately, so that they might or might not be awarded to the same company. Again, as in the Fifth Round, licenses would be valid for two periods totaling 7 years, with one-third of the licensed area retained for an additional 30 years.

Two moves by the Government tended toward a further strengthening of its control over the industry. In April 1978, the BNOC was given the right of first refusal on all pre-Fifth Round oil license transfers. Then, in August, the Government proposed to Parliament that the Petroleum Revenue Tax (PRT) be changed. (This tax is in addition to royalties and the corporate income tax.) The proposal was to (1) raise the PRT from 45% to 60% as of December 31; (2) reduce the "uplift," or additional tax credit, for capital expenditures to commence or increase production, from 75% (which amounts to a 175% total tax credit on approved expenditures) to 35% (or a 135% total credit); and (3) cut the oil allowance, which is free of the PRT, from 1 million tons per year to 500,000 tons per year, with the maximum allowance for any one field to be cut from 10 million tons per year to 5 million tons per year.

The advent of the Conservative Government in 1979 resulted in several changes in Government policy toward the petroleum industry. It had been the Government's intent to sell off all or part of the assets of the BNOC, but the plan was later abandoned for political reasons. The BNOC was later asked to raise about £400 million through the issuance of bonds or shares, both to broaden its ownership base and to help reduce the national budget deficit. Plans to sell the British Petroleum Company Ltd. (BP), which represented 5% of the Government's 51% holding in the BNOC, were set later in the year, but there were no plans for further sales.

Four more fields came into production in the North Sea during 1978. These were Thistle, with 530 million barrels of recoverable reserves, operated by the BNOC, in February; Dunlin, 592 million barrels, by

Shell Transport and Trading Co. Ltd., U.K., in August; Heather, 148 million barrels, by Union Oil Co., in October; and Ninian, 1,000 million barrels, by Standard Oil Co., in December. This brought the total number of operating fields to 12, until late in 1979. Then, the South Cormorant field in the East Shetland Basin, operated by Shell, went onstream at 30,000 barrels per day on December 11, 1979. Ultimately this field was expected to produce 60,000 barrels per day.

Four oil groups sought permission late in 1979 to develop new offshore oilfields. Plans were for the Hutton field, with reserves of 250 million barrels, to be developed by Continental Oil Co., BP, the BNOC, and five other companies. The Thistle field group (composed of Burmah Oil Co. Ltd. and others) was expected to ask for a new field in block 211-18. Marathon Oil Co., along with the BNOC and others, planned to develop a major extension of the Brae field that would make possible an anticipated production of 100,000 barrels per day by 1983. Also, Mobil Corp. was seeking permission to extend the Beryl field with a second platform.

The £813 million Sullom Voe terminal in the Shetland Islands was opened in November 1978. It was expected to eventually be the largest oil terminal in Europe, with a throughput of 1.4 million barrels per day from the Ninian field and the Brent system. Expansion of Sullom Voe, by adding storage and loading facilities and a fifth jetty, could ultimately raise its capacity to 2 million barrels per day, at a final total cost of £1.2 billion.

The median line between the United Kingdom and Norway was extended northward to 63°53' 40.03N, by mutual agreement, through strict application of the equidistance principle.

The refinery planned by Occidental Petroleum Co. on Canvey Island in the Thames estuary, which had been expected to cost over £200 million, was cancelled because of what the company described as "an unexpected escalation of construction costs." The refinery had been criticized on the grounds that it would add unnecessary capacity (120,000 barrels per day) at a time when U.K. and European refineries were operating well below capacity. Another planned refinery, Cromarty Petroleum Ltd.'s 200,000-barrel-per-day plant at Nigg Point, on Cromarty Firth in Scotland, was also abandoned.

Uranium.—Two areas in the United Kingdom were under examination for uranium deposits. In County Tyrone, Northern Ireland, Sabina Industries Ltd. of Canada and E & B Exploration Ltd. provided 50% each toward an initial $165,000 program of stream and water samples and analysis on the Fintone block. The European Economic Community provided a grant of £350,000 to Minatome, a subsidiary of the French companies PUK and Total-CFP, to undertake prospecting for uranium in Cornwall and southern Scotland. Charter Consolidated Ltd. was also participating in the venture. Speaking against uranium development, however, were the Orkney Islanders, who mounted a protest against possible uranium mining around Stromnes and Yesnaby on the island's west coast.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] £1.00 = US$1.94, average exchange rate in 1978; in 1979, the exchange rate rose to about £1.00 = US$2.10.

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The Mineral Industry of Venezuela

By Doris M. Hyde[1]

In 1978 and 1979, petroleum accounted for 63% and 65%, respectively, of total Government revenue earnings as compared with 71% in 1977. Revenue contributions from other segments of the mineral industry were modest. Import expenditures on industrial expansion in steel, aluminum, and hydropower continued and contributed to a 1978 adverse balance of trade estimated at $1.5 billion, as opposed to about $289 million in 1977.[2] Although imports declined by $400 million in 1979, it was the upward price spiral of petroleum exports that accounted for an estimated $4 billion positive trade balance.

In real terms, the gross domestic product (GDP) grew by 4.9% in 1978 and by 4% in 1979. The mineral export sector, primarily the petroleum industry, accounted for 9.2% of the real GDP in 1978 and 9.6% in 1979.

Despite the $613.9 million spent in 1977, the $1.0 billion in 1978, and the $1.5 billion spent by the petroleum industry in 1979, light- and medium-gravity crude oil productive capacity has continued to decline. New discoveries of light oil in the Maracaibo region have slightly increased reserves, and offshore drilling in 1979 showed promise of additional light oil and natural gas reserves. As crude oil prices continue to increase and market conditions warrant, marginal fields containing as much as 7 billion barrels of recoverable reserves may be brought back onstream.

Expansions underway in the steel industry are expected to be completed by 1980. Final planning for the steel complex in the State of Zulia, near Maracaibo, made slow progress in 1978 and 1979, partially attributed to a hesitancy on the part of the Government to commit itself to large capital investments in the face of a number of uncertainties.

Government Policies and Programs.—Ministry of Energy and Mines Resolution 148 of March 21, 1978, detailed implementation procedures for changes in the mining law established by the February 1977 issuance of Presidential Decree No. 2039. These new regulations detail the procedures and requirements the applicant must follow to obtain prospecting licenses and, subsequently, exploration and mining concessions. Financial and technical competence must be documented by applicants. Development plans are also required, which may offer special advantages, such as worker training and maximum use of Venezuelan technical services and equipment.

It was anticipated that the new regulations will permit an exhaustive evaluation of Venezuela's mineral resources. The Government also expected them to eliminate the former practice of some concession holders of retaining their concessions with no incentive for timely development.

In June 1978, the Venezuelan Income Tax Court upheld a 1976 claim by the Comptroller General against American Petrofina of Venezuela for outstanding assessments due under the Comptroller's interpretation of legislation enacted in December 1970 and implemented in March 1971. In October 1979 the Venezuelan Supreme Court refused to hear Petrofina's appeal. The controversy stemmed from a general understanding on the part of the foreign oil companies that the higher level of reference prices used as a basis for tax levies would be effective for the year 1971. The Comptroller ruled that the legislation was retroactive and, therefore, also applied to 1970. The additional assessment claim of $23,225 against Petrofina may be significant as a precedent in that there remain a number of outstanding tax levy claims against the Guarantee Fund deposits of the former oil company concessionaires and participants amounting to over $465 million. In 1979 about $380 million remained in the Guarantee Fund.

Other actions also affected the oil company ex-concessionaires. In March 1978, the Government published in the Offical Gazette, 38 separate but similarly worded resolutions issued by the Ministry of Energy and Mines which set forth the amounts to be deducted from each company's Guarantee Fund deposit for the renovation of assets nationalized in December 1975. The total sum deducted for renovation amounted to about $134 million.

In July 1978, the Venezuela Supreme Court ruled that Occidental Petroleum Co. was entitled to pursue in the courts its suit for compensation for the nationalization of its assets in Venezuela, a claim which had been delayed pending investigation of various allegations. Although the Attorney General is obligated to answer Occidental's suit, originally filed in May 1977, no time limit was specified for the response.

PRODUCTION

Venezuela's mineral industry in 1978 continued to be dominated by petroleum and iron ore. In 1979 aluminum surpassed iron ore in contributions to the economy; the increased production was from Venezuela's second aluminum smelter, Industria Venezuelana de Aluminio (Venalum), which came onstream in 1978.

Increased operating costs and a slightly lower average price defeated iron ore production gains in 1979 as the industry continued to suffer from poor world market conditions. In 1979 net profit to the industry was about one-half of that reported for 1977 and 6% less than for 1978, in spite of the production increase of over 2.6 million tons in 1979 over that of each of the two preceding years.

World events in 1979 escalated the demand and price for crude oil, and Venezuela increased production to an average of 2.35 million barrels per day. Production in 1978 averaged 2.165 million barrels per day. Late in 1979 the Government announced a crude oil production cut of 150,000 barrels per day for 1980. The per barrel production cost in relation to total investment for 1978 increased 71% over that of 1977, partly because of the deeper drilling required in new exploration for light crude, completion of preparations for costly offshore drilling, the implementation of additional secondary recovery, and improvements to refining facilities. The per barrel cost for 1979 increased 37% over that for 1978.

Other sectors of the mineral industry registered mixed performances during 1978 and 1979.

Table 1.—Venezuela: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum, unalloyed ingot	46,500	43,400	75,384	200,000
Gold, mine output, metal content ... troy ounces	16,506	17,403	11,960	14,000
Iron and steel:				
Iron ore and concentrate ... thousand tons	18,685	13,683	13,600	16,000
Metal:				
Pig iron ... do	422	497	693	[e]1,874
Ferroalloys ... do	3	[e]3	15	40
Steel ingots and castings ... do	937	855	860	[e]1,586
Semimanufactures ... do	1,174	1,162	1,081	1,200
Lead, secondary, smelter[e]	7,000	8,000	9,000	10,000
NONMETALS				
Cement, hydraulic ... thousand tons	3,538	3,136	3,426	4,000
Clays:				
Kaolin	7,821	10,000	23,057	10,000
Other ... thousand tons	2,273	2,450	3,342	NA

See footnotes at end of table.

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Table 1.—Venezuela: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Diamond:				
Gem carats	195,700	203,600	278,000	285,000
Industrial do	653,900	483,500	460,000	465,000
Total do	849,600	687,100	738,000	750,000
Feldspar	65,608	26,020	70,262	69,800
Gypsum	110,841	155,892	366,855	362,800
Salt, all types	[e]300,000	241,000	158,000	155,000
Stone, sand and gravel:				
Stone:				
Broken stone and dust, not further described thousand tons	NA	NA	1,694	1,700
Dolomite	NA	NA	84,662	85,000
Granite	722	235	--	--
Limestone thousand tons	21,515	18,995	32,736	35,000
Marble cubic meters	NA	NA	139	140
Serpentine	1,126	NA	NA	NA
Sand and gravel thousand tons	14,499	23,238	21,667	22,000
Sulfur, byproduct of petroleum and natural gas	90,000	95,000	95,000	95,000
MINERAL FUELS AND RELATED MATERIALS				
Carbon black[e] thousand tons	52	78	31	30
Coal, bituminous	86,600	120,800	90,000	100,000
Gas, natural:				
Gross million cubic feet	[r]1,311,392	1,324,702	1,230,437	[2]1,304,624
Marketable do	[r]479,807	523,667	520,171	[2]575,556
Natural gas liquids:				
Condensate thousand 42-gallon barrels	[r]1,421	874	101	50
Natural gasoline do	7,271	7,158	5,321	[2]6,373
Liquefied petroleum gas do	20,524	20,593	16,995	[2]18,470
Total do	[r]29,216	28,625	22,417	24,893
Petroleum:				
Crude do	839,740	816,820	790,420	858,830
Refinery products:				
Gasoline:				
Aviation do	672	710	200	[2]271
Motor do	43,344	47,260	51,810	[2]54,102
Jet fuel do	9,113	10,706	11,187	[2]10,977
Kerosine do	5,288	6,560	3,965	[2]3,699
Distillate fuel oil do	45,278	50,054	51,555	[2]56,484
Residual fuel oil do	216,028	200,645	206,335	[2]202,306
Lubricants do	2,464	2,389	2,873	[2]3,163
Other:				
Liquefied petroleum gas do	2,643	3,204	2,424	[2]1,446
Asphalt and bitumen do	3,734	4,285	5,544	[2]8,278
Naphtha do	22,781	20,141	17,320	[2]16,906
Refinery gas[3] do	6,807	6,766	6,534	[2]6,692
Unspecified do	2,734	3,028	2,146	[2]2,841
Total do	360,886	355,748	361,893	367,165

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities listed, lime is produced, but available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

[3] Liquid equivalent.

TRADE

Exports of crude oil and refined petroleum products accounted for 95% of the total value of exports in 1978 and 1979. In 1979, aluminum displaced iron ore as the second major mineral export when aluminum exports were valued at $156 million and iron ore at $142 million.

Export sales of petroleum during 1979 soared to $13.7 billion, a 57% increase over the $8.7 billion for 1978. This amount was primarily due to the 44% increase in the overall average price of petroleum and petroleum products that occurred during 1979 rather than to increased volumes. By the end of 1979, petroleum prices had increased an average of 85% more than those of December 31, 1978. Additional price increases were scheduled to become effective January 1, 1980.

New petroleum marketing agreements

between Petróleos de Venezuela, S.A. (PDVSA) and foreign companies were agreed to in principle in 1979 and were expected to be formalized early in 1980. These agreements will limit sales through multinational companies to 50% of total petroleum exports. In 1979 these sales equaled about 65% of petroleum exports. The remainder of petroleum exports will be through increased Government-to-Government contracts and PDVSA direct sales to users.

In 1978 the United States imported 48% of Venezuela's iron ore exports and small quantities were sold to new markets in the German Democratic Republic, Romania, and Colombia. In 1979, the U.S. share of iron ore exports dropped to 36%, while sales to Europe increased to 59%. Sales to the German Democratic Republic in 1979 increased 160% over those of 1978, and sales to the United Kingdom and France increased 74% and 36%, respectively, over 1978 figures.

Table 2.—Venezuela: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal destinations, 1976
METALS			
Aluminum metal including alloys:			
Scrap	1,528	--	
Unwrought	10,410	11,296	Colombia 5,149; Peru 3,509; Argentina 1,119.
Semimanufactures	171	4,590	Colombia 2,346; Brazil 1,500; Peru 615.
Copper metal including alloys, semimanufactures	19	23	Colombia 18; Puerto Rico 3.
Iron and steel:			
Ore and concentrate thousand tons	19,850	16,140	United States 9,200; Italy 1,888.
Metal:			
Pig iron, ferroalloys, similar materials	(1)	77	All to Dominican Republic.
Steel, primary forms	(1)	21	Mainly to Trinidad and Tobago.
Semimanufactures	1,649	20,373	Singapore 6,546; Nigeria 4,100; Hong Kong 3,153; Spain 2,480; Algeria 2,410.
Nickel metal including alloys, all forms	23	55	Mainly to United States.
Platinum-group metals and silver, waste and sweepings troy ounces	4,565	5,465	All to United States.
Zinc metal including alloys, all forms	298	236	United States 125; Brazil 89.
Other:			
Ash and residue containing nonferrous metals	(1)	3	All to Netherlands.
Oxides, hydroxides, peroxides of metals	137,871	196,019	United States 62,896; Denmark 38,5[illegible]; Brazil 39,389; Italy 19,853.
Metals including alloys, all forms	1	1	All to Netherlands.
NONMETALS			
Abrasives, natural:			
Pumice, emery, natural corundum, etc	3	1	All to Netherlands Antilles.
Grinding and polishing wheels and stones kilograms	4,639	28,207	Mainly to Trinidad and Tobago.
Asbestos	(1)	--	
Cement, hydraulic	35,759	92	All to Netherlands Antilles.
Clays and clay products (including all refractory brick):			
Crude	(2)	10	All to Colombia.
Products:			
Refractory	1,548	1,382	Argentina 972; Ecuador 319.
Nonrefractory	598	404	Puerto Rico 261; Netherlands Antilles 140.
Diamond, gem thousand carats	1,240	765	Netherlands 430; United States 24[illegible]
Fertilizer materials:			
Crude	3	5	All to Netherlands Antilles.
Manufactured	6,838	46,694	Brazil 26,747; Colombia 11,[illegible]; Peru 6,000.
Gypsum and plasters	16,960	17,800	Trinidad and Tobago 14,400; Surinam 3,400.
Lime	66	14	Brazil 7; Netherlands Antilles 7.
Precious and semiprecious stones, except diamond value, thousands	869	--	
Salt	975	(1)	All to Netherlands Antilles.
Sodium and potassium compounds, n.e.s	2,068	--	
Stone, sand and gravel:			
Dimension stone	1,962	1,465	Netherlands Antilles 570; St. Lucia 498.
Crushed and broken stone for cement and lime manufacture	114	351	All to Netherlands Antilles.
Quartz and quartzite	85	60	All to Poland.
Sand	2,995	481	Mainly to Trinidad and Tobago.

See footnotes at end of table.

Table 2.—Venezuela: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal destinations, 1976
NONMETALS —Continued			
Sulfur:			
Elemental	7,419	18,931	Mainly to Colombia.
Sulfuric acid	13,859	15,976	Netherlands 5,989.
Other: Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	1,277	2,880	Mainly to Netherlands Antilles.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	20,493	75,061	Argentina 50,779; Brazil 18,813.
Hydrogen, helium, rare gases	6	19	Colombia 16; Netherlands Antilles 3.
Natural gas liquids:			
Natural gasoline thousand 42-gallon barrels	3,894	3,505	United States 2,378; Netherlands 652.
Liquefied petroleum gas do	10,907	12,019	United States 6,781; Argentina 1,630.
Petroleum:			
Crude and partly refined do	541,310	502,065	Netherlands Antilles 171,696; United States 130,035; Canada 84,238.
Refinery products:			
Gasoline and naphtha do	15,739	19,136	United States 12,944.
Jet fuel do	3,136	3,360	United Kingdom 1,046; Peru 1,009; United States 544; Netherlands 336.
Kerosine do	--	106	All to Honduras.
Distillate fuel oil do	25,109	20,941	Sweden 3,397; United Kingdom 1,836.
Residual fuel oil do	166,001	221,827	United States 159,503; Netherlands Antilles 22,597.
Lubricants do	2,208	1,366	Brazil 403; Sweden 331; France 217.
Asphalt do	529	81	Dominican Republic 42; Guatemala 15; Bahamas 9; Bermuda 9.
Other do	3,002	2,505	Argentina 957; West Germany 920.
Total do	215,724	269,322	

[1] Less than 1/2 unit.

Table 3.—Venezuela: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
METALS			
Aluminum:			
Bauxite and concentrate	3,545	10,006	Mainly from Guyana.
Oxide and hydroxide	62,390	328,787	Jamaica 96,574; Guyana 66,345; Surinam 61,700; United States 59,295; Virgin Islands 34,271.
Metal including alloys:			
Unwrought	109	2,186	Mainly from Japan.
Semimanufactures	8,564	8,991	United States 4,104; United Kingdom 1,512.
Antimony metal including alloys, all forms	83	101	Italy 32; Japan 31; United States 27; Peru 10.
Arsenic trioxide, pentoxide, acids	38	21	Mexico 13; United States 11; West Germany 6.
Chromium:			
Chromite	5,000	12,500	Mainly from Philippines.
Oxide and hydroxide	131	135	United States 91; West Germany 14.
Copper:			
Ore and concentrate	5	1	Mainly from Spain and Brazil.
Copper sulfate	281	190	West Germany 38; Chile 35; France 30; Netherlands 20; Peru 20; U.S.S.R. 19.
Metal including alloys:			
Scrap	418	139	Puerto Rico 56; United States 52; Italy 31.
Unwrought	3,866	4,217	United States 2,597; Canada 654; West Germany 526.
Semimanufactures	12,898	18,430	Chile 6,393; United States 4,247; Canada 3,558; West Germany 1,839.
Gold metal, unworked or partly worked troy ounces	13,696	29,417	United States 18,068; Peru 9,066.
Iron and steel:			
Ore and concentrate	58	267,266	Mainly from Peru.
Metal:			
Scrap	56,174	44,493	United States 32,844; Yugoslavia 9,950.
Pig iron, ferroalloys, similar materials	168,527	129,953	India 58,077; United States 18,174.
Steel, primary forms	549,843	615,696	Japan 260,754; Belgium-Luxembourg 89,390; Italy 86,952.

See footnotes at end of table.

Table 3.—Venezuela: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Semimanufactures:			
Bars, rods, angles, shapes, sections	198,273	332,719	Japan 187,102; West Germany 37,894.
Universals, plates, sheets	409,792	399,166	Japan 281,966.
Hoop and strip	5,418	3,994	Japan 2,157; United States 1,233; West Germany 873; United Kingdom 630.
Rails and accessories	8,910	18,228	United States 14,852.
Wire	5,036	5,195	Japan 1,139; Brazil 899; United States 820; Belgium-Luxembourg 813.
Tubes, pipes, fittings	172,146	66,848	West Germany 17,739; United States 13,568; Japan 12,222; Italy 10,534.
Castings and forgings, rough	7,827	3,287	United States 1,600; United Kingdom 691; Spain 352; Belgium-Luxembourg 348.
Total	907,406	851,437	
Lead:			
Oxides	1,085	2,444	Mexico 1,671; United States 422.
Metal including alloys, all forms	9,693	8,712	Puerto Rico 3,926; United States 2,302.
Magnesium metal including alloys, all forms	325	185	United States 163; Norway 19.
Manganese:			
Ore and concentrate	100	5	All from United States.
Oxide	1,152	1,645	Mexico 864; United States 569; Japan 187.
Mercury 76-pound flasks	456	479	United States 233; West Germany 2
Molybdenum metal including alloys, all forms	8	3	Netherlands 1; United Kingdom 1; United States 1.
Nickel:			
Matte, speiss, similar materials	3	(1)	All from Italy.
Metal including alloys, all forms	568	661	United States 314; Japan 85.
Platinum-group metals including alloys, all forms troy ounces	25,817	143,681	Spain 59,800; Switzerland 56,342; United States 16,011.
Silver metal including alloys do	437,314	700,340	United States 529,104; France 77,9
Tin:			
Oxides	12	13	Mainly from United States.
Metal including alloys, all forms	657	390	United States 194; Switzerland 88; Netherlands 58.
Titanium oxides	1,290	6,352	United States 4,936.
Tungsten metal including alloys, all forms	10	36	United States 32.
Uranium metal including alloys, all forms kilograms	7	---	
Zinc:			
Oxides	883	300	West Germany 100; United States 82; Colombia 46; United Kingdom 42.
Metal including alloys:			
Scrap and blue powder	244	250	United States 177; West Germany 40; Belgium-Luxembourg 31.
Unwrought	9,798	13,864	Canada 4,669; Mexico 3,631; Belgium-Luxembourg 2,063.
Semimanufactures	377	1,076	Mexico 901; Japan 100.
Other:			
Ores and concentrates	417	875	United States 314; Australia 177.
Ash and residue containing nonferrous metals	2	1	Mainly from Spain.
Oxides, hydroxides, peroxides of metals	375	1,020	United States 822.
Metals including alloys, all forms	330	164	United States 125.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	140	160	United States 55; Italy 45; West Germany 41.
Grinding and polishing wheels and stones	86	113	United States 39; Italy 36; West Germany 22.
Asbestos	15,548	17,624	Canada 14,564.
Barite	29,923	41,729	United Kingdom 17,887; Peru 11,197; Ireland 6,402; United States 6,0
Boron materials:			
Crude natural borates	439	92	United States 66; Netherlands 25.
Oxide and acid	702	242	United States 207; West Germany 2
Salts	1,269	1,224	Mainly from United States.
Cement	29,337	502,384	Spain 233,534; Mexico 1 ; France 84,813.
Chalk	518	468	France 418.

See footnotes at end of table.

Table 3.—Venezuela: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
NONMETALS —Continued			
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	7,419	19,233	Mainly from United States.
Kaolin	16,542	24,530	United States 21,616; United Kingdom 2,708.
Other	3,756	4,692	Mainly from United States.
Products:			
Refractory (including nonclay brick)	7,666	19,697	United States 17,735.
Nonrefractory	16,377	52,959	Italy 29,092; Colombia 16,948.
Cryolite and chiolite	11	23	West Germany 18; Denmark 5.
Diamond:			
Gem, not set or strung thousand carats	770	150	Mainly from Netherlands.
Industrial do.	485	2,140	Belgium-Luxembourg 1,100; United States 975.
Diatomite and other infusorial earth	3,978	4,193	United States 2,655; Mexico 1,426.
Feldspar, leucite, nepheline, nepheline syenite	201	696	United States 413; Finland 80.
Fertilizer materials:			
Crude	4	1	Mainly from United States and France.
Manufactured:			
Nitrogenous	250,906	217,446	Belgium-Luxembourg 88,664.
Phosphatic	4,587	--	
Potassic	22,859	8,816	Mainly from Austria.
Other	71	6	Mainly from West Germany.
Ammonia	20	22	West Germany 15; United Kingdom 3; United States 2.
Fluorspar	390	5,429	Mexico 2,818; United States 2,501.
Graphite, natural	279	405	United States 287; Spain 92.
Gypsum and plasters	589	569	West Germany 240; United States 140; United Kingdom 112.
Iodine	7	12	United States 5; West Germany 2; United Kingdom 2; Japan 1; Netherlands 1.
Lime	60	127	All from United States.
Magnesite	8,691	377	Czechoslovakia 308.
Mica:			
Crude, including splittings and waste	412	282	Mainly from United States.
Worked, including agglomerated splittings	7	7	United States 5; Italy 1; Japan 1.
Pigments, mineral:			
Natural, crude	56	15	United Kingdom 10; United States 3.
Iron oxides, processed	1,228	1,273	Spain 399; Netherlands 310; West Germany 266.
Precious and semiprecious stones, except diamond, natural and synthetic kilograms	2,919	7,192	Chile 3,928; Brazil 942; Mexico 771.
Pyrite	37	81	All from United States.
Salt	78	24	United States 21; West Germany 3.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	65,884	53,680	United States 35,676; Panama 12,077.
Caustic potash and sodic and potassic peroxides	457	69	United States 34; West Germany 22; France 10.
Soda ash	27,654	69,974	Mainly from United States.
Stone, sand and gravel:			
Dimension stone, crude and worked	7,890	6,195	Italy 4,404.
Gravel and crushed rock	255	98	France 70; West Germany 13; Norway 10.
Dolomite, chiefly refractory grade	33,696	16,013	Mainly from United States.
Quartz	133	95	Sweden 62; United States 28.
Sand	252	209	Mainly from United States.
Sulfur:			
Elemental:			
Other than colloidal	44	117	West Germany 76; United States 37.
Colloidal	25	77	Belgium-Luxembourg 61; United States 11.
Sulfur dioxide	122	102	Mainly from United States.
Sulfuric acid	53	126	West Germany 36; Sweden 32; United States 23; United Kingdom 14.
Talc and steatite	6,492	8,227	United States 6,229.
Other:			
Crude:			
Vermiculite	438	507	Mainly from Africa.
Other	21	31	All from France.
Slag, dross, and similar waste, not metal bearing	3	4,610	Mainly from West Germany.
Oxides and hydroxides of magnesium, strontium, barium	13,241	22,253	Japan 18,208; United States 3,732.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	671	3,558	Colombia 2,271; United States 1,109.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	451	469	All from United States.
Carbon black and gas carbon	576	791	United States 369; Japan 135; West Germany 115; Colombia 90; Canada 79.

See footnotes at end of table.

Table 3.—Venezuela: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
MINERAL FUELS AND RELATED MATERIALS —Continued			
Coal, all grades, including briquets	7,407	13,564	Mainly from United States.
Coke and semicoke of coal and lignite	288,008	184,578	Poland 69,879; Japan 55,024; Colombia 26,244; United States 20,460.
Hydrogen, helium, rare gases	42	8	Mainly from United States.
Peat, including peat briquets and litter	24	38	West Germany 20; Finland 11; Netherlands 7.
Petroleum:			
Crude and partly refined ..... 42-gallon barrels	308	4,188	Mainly from Sweden.
Refinery products:			
Gasoline ..... do	603	134	United States 88; United Kingdom 20; West Germany 13.
Kerosine and jet fuel ..... do	2,032	3,024	United States 2,143; Netherlands 847.
Distillate fuel oil ..... do	1	1	All from United States.
Residual fuel oil ..... do	(1)	(1)	All from El Salvador.
Lubricants ..... do	152,620	108,159	United States 63,762; Curaçao 26,207; Netherlands 15,420.
Other:			
Mineral jelly and wax ..... do	33,051	32,250	United States 17,826; West Germany 7,710.
Liquefied petroleum gas ..... do	124	40	Mainly from United States.
Nonlubricating oils, n.e.s ..... do	2	6	United States 4; West Germany 1.
Pitch and pitch coke ..... do	125,352	62,885	United States 55,138; Colombia 7,066.
Petroleum coke ..... do	110,761	103,736	Mainly from United States.
Bitumen and other residues ..... do	1,693	1,607	Japan 1,408.
Bituminous mixtures ..... do	970	415	Mainly from United States.
Total ..... do	427,209	312,257	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	10,220	17,296	Do.

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—The first 70,000-ton-per-year stage of Venezuela's second aluminum smelter came onstream in mid-1978 and marked an important step in the expansion of the mineral industries. At the end of 1979, 420 of the total 720 pot cells were in operation and plant completion was projected for 1980. However, it was also reported that this Ciudad Guayana plant of Industria Venezolana de Aluminio (Venalum) encountered production problems which could delay achievement of the full 280,000-ton-per-year capacity until 1981. These problems resulted in a disappointing 14,500 tons of aluminum output for 1978, but Venalum estimated 1979 production at 121,500 tons, with 220,000 tons targeted for 1980. In 1979 Venalum was considering the possibility of adding a fifth 70,000-ton-capacity potline.

The Aluminio del Caroni, S.A. (Alcasa) smelter at Ciudad Guayana operated below its 120,000-ton-per-year capacity during 1978 and 1979. Financial problems experienced by Alcasa during those years have been attributed to an aggregation of factors including labor problems, poor management, poor maintenance, expansion cost overruns, and an unfavorable sales contract.

Since the new alumina plant of Interamericana de Alúmina, C.A. (Interalumina) is not scheduled for production until 1982, Venezuela signed an agreement with Suriname in July 1978, which provided for alumina purchases of 25,000 tons per year until the new facility is operational. Also in July, another agreement was signed with Suriname which provided for Venezuela to purchase bauxite for use in the new alumina plant. The agreement provided for an adjustment of quantities after Venezuela's Los Pijiguaos deposits are under production. Suriname agreed to make its bauxite mining technology available to Venezuela, and provision was made for the formation of a joint Venezuela-Suriname commission to be appointed to study all aspects of a possible integration of the aluminum industry of the two countries.

Venezuela may obtain additional bauxite resources as Cia. Vale do Rio Doce (CVRD) announced plans to sell 5% of its share of equity in Brazil's Trombetas bauxite project to Corporación Venezolana de Guayana (CVG), which holds an 85% interest in Interalumina.

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In 1979 a new State company, CVG Bauxita Venezolana, C.A. (Bauxiven), was established to mine and market the bauxite deposits at Los Pijiguaos in the State of Bolívar. It was reported that the Swiss firm Aluminio Suizo, S.A. (Alusuisse), which has an interest in Interalumina, will assist CVG in developing the estimated 500 million tons of reserves. Another 40 million tons of bauxite deposits were reported as having been discovered in the eastern region of the State of Guayana.

Gold.—About 80% of 1978 gold production came from operations of the Sindicato de Patrones Mineros, 1% came from independent miners, and 19% from other concessionaires. In 1979 the Sindicate accounted for over 92% of production while independent miners and the other concessionnaires produced about 6% and 2%, respectively. The continuing rise in world market gold prices softened the impact of a 1978 production decline and encouraged increased 1979 production.

Iron Ore.—The mines of Cerro Bolívar yielded 69% of total Venezuelan iron ore production during 1978, while the El Pao mines contributed 27% and the San Isidro deposits almost 4%. In 1979, Cerro Bolívar produced 51% of total production, El Pao yielded 27%, the now-producing Altamira deposit 16%, and San Isidro accounted for 6%. About 600,000 tons of ore were consumed domestically in 1978 and 700,000 tons in 1979.

Net industry earnings from iron ore in 1978 were estimated at $12.7 million, a substantial decline from 1977 earnings of $24.2 million. Although there was some improvement in the volume of export sales over those of 1977, the 1978 decrease in net earnings reflected continued poor world market supply-demand conditions. During 1979 sales again increased but net earnings were estimated at $11.9 million, mainly as a result of increased costs.

In 1978 CVG Ferrominera Orinoco, C.A., announced the investment of over $58 million for the expansion of crushing, drying, and screening facilities, and the completion of a railway between Ferrominera installations and the Siderúrgica del Orinoco (SIDOR) steel complex in the State of Guayana. Increased demand from the expansion of SIDOR's pelletizing and steelmaking plants and the prospects of a second integrated steel complex in the Maracaibo region accounted for Ferrominera's decision to upgrade its installations.

In November 1978, SIDOR's two-strand 6.6-million-ton-per-year iron ore pelletization plant was brought onstream. The plant, part of SIDOR's $3,500 million expansion program, was reported to be the largest of its kind in the world.

Venezuela's estimated proven iron ore reserves grading over 55% iron total 1,748 million tons; reserves under 55% iron total 575 million tons. Deposits of ferruginous quartzite containing 35% to 45% iron are estimated at about 8 to 10 billion tons.

Iron and Steel.—In 1978 Ferrominera allocated $35 million to remodel the direct-reduction high iron briquet (HIB) plant at Puerto Ordaz which had closed in 1977 due to operational problems. The plant entered its startup phase in 1979. It was reported that the production will go to the export market.

Fior de Venezuela, S.A., a privately held company, brought its concentrated iron ore briquette plant onstream in 1978. The plant uses a fluidized direct-reduction process developed by Exxon Corp. to produce iron briquettes of about 92% concentration. The product was designed to be used in electric furnaces but may have other uses in steel manufacturing. Annual production was expected to reach 280,000 tons in 1980 and 300,000 tons in 1981.

During 1979 SIDOR brought three Midrex direct-reduction modules onstream. A three-module, direct-reduction plant using the Hyl process developed by the Mexican company Hojalata y Lámina S.A. (HYLSA), was scheduled to come onstream in late 1979 or early 1980. When fully operational these plants, and the one-module Midrex and Hyl plants commissioned in 1977, will provide an annual sponge iron capacity of almost 4 million tons.

Shortages of skilled labor, high operating costs, and technical difficulties have worsened SIDOR's financial status and it has continued to operate at a loss since 1977. The steel complex employed about 15,000 workers in 1978 and was expected to reach 20,000 by 1980. Worker training programs were emphasized and an assistance agreement was signed with Empresa Nacional Siderúrgica de España, S.A. (ENDESSA), of Spain to allow SIDOR's employees to be trained in Spanish steelworks. Another agreement with Nippon Steel Corp. will provide SIDOR with technical assistance for the operation of newly installed steelmaking equipment. SIDOR anticipated that capacity steel output would be achievable by 1984.

Development of the new steelmaking complex planned for the Maracaibo region in the State of Zulia progressed slowly as international bidders for a 49% equity partnership were evaluated. The cautious approach to a firm commitment to proceed with the Zulia steel complex was variously attributed to some uncertainty over financial priorities, the previous commitment to SIDOR's ongoing expansion and modernization, and to the problems experienced by SIDOR with skilled labor shortages and poor productivity, which could forewarn of similar problems at the Zulia complex. At the end of 1979 the project was still under active consideration and study.

In late 1979, Siderúrgica Venezolana, S.A. (Sivensa), Venezuela's largest private steel company, announced its intention to acquire Siderúrgica del Turbio (Sidetur), the second largest private steel company.

NONMETALS

Cement.—In 1978 a strong domestic demand and a desire to stockpile against possible future shortages led the Government to contract with the Colombian Government for the importation of cement at the rate of 425,000 tons per month. Total imports of Colombian cement were expected to reach at least 3.8 million tons during 1978 and 1979.

Construction of new plants and plant expansions during 1978 and 1979 were expected to increase national output to about 8.1 million tons per year.

Diamond.—The total value of diamond production during 1978 was about $46 million, registering a substantial gain over that of 1977 because of the greater proportion of gem quality stones produced. In 1979 the total value declined to about $42 million owing to the increased proportion of Bort grade diamonds. In 1979 Venezuela began to expell illegal foreign diamond prospectors.

The majority of production comes from the alluvial gravels in the Paragua and Caroní Rivers. It has been theorized that the diamonds originated in conglomerates of the Mesozoic Roraima series. The Roraima has been considered the same as the Kaieteur Series in the diamondiferous region of Guyana. Kimberlite minerals have been identified in recent sedimentary deposits in the western part of the State of Bolivar and additional exploratory work is underway.

MINERAL FUELS

Coal.—The State of Tachira coal deposits provided 58% of total production in 1978, while 41% came from the Naricual mines in the State of Anzoátegui and 1% from other areas. Coal production from the State of Zulia has continued to undergo evaluation studies. A drastic 98% reduction in output from the mines of C.A. Minas de Carbón de Naricual during 1979 resulted in total coal production decreasing substantially from that of 1978, despite a 20% increase in production from the C.A. Minas de Carbón de Lobatera operation in the State of Tachira. In 1978, lower output from the Naricual mines was also largely responsible for the sizable overall production decline from the 1977 level.

In October 1978, the Government established a new company, Carbones del Zulia, C.A. (Carbozulia), to exploit the Guasare coal deposits in the State of Zulia. The ownership of the new company is shared by Corporación de Desarrolla del Estado de Zulia (Corpozulia) (60%), and Fondo de Inversiones de Venezuela (40%). Carbozulia was capitalized at $39.7 million. Prequalification of contractors for mine design and railroad transport projects was to begin in 1979. Early in 1978 open pit operations for coal analyses were begun on Seam IV near Paso del Diablo. Open pit mining of the 12-foot-thick Seam IV down to a depth of 200 meters should yield 70 million tons of coal with total recoverable reserves estimated at 120 million tons. Projections of total coal reserves in the Guasare belt were greater than 1,500 million tons. During 1979 progress continued on drilling, road building, and coal analyses.

Petroleum and Natural Gas.—In 1978 Petróleos de Venezuela S.A. (PDVSA) completed its internal reorganization. Final consolidation of subsidiaries has resulted in four major operating companies, as shown below:

New operating company	Companies consolidated
Corpoven, S.A	Bariven, S.A. (Barinas field). Boscoven, S.A. Corp. Venezolana de Petróleo. Deltaven, S.A. Llanoven, S.A. Palmaven, S.A.
Lagoven, S.A	Amoven, S.A. Lagoven, S.A. Roqueven, S.A. (eastern fields).
Maraven, S.A.	Maraven, S.A. Roqueven, S.A. (western fields). Taloven, S.A. (western fields). Vistaven, S.A. (western fields).
Meneven, S.A	Bariven, S.A. (El Chaure refinery). Guariven, S.A. Meneven, S.A. Roqueven, S.A. (San Roque refinery). Taloven, S.A. (eastern fields). Vistaven, S.A. (eastern fields).

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In its effort to revitalize Venezuela's petroleum industry and reverse the decline in light oil production, PDVSA invested over $1.1 billion for production, exploration, refining, and marketing operations in 1978. In 1979 investment spending was increased to about $1.5 billion, and a $2.9 billion program was announced for 1980. PDVSA net earnings for 1978 declined about 20% from those in 1977 to $1.45 billion. The profit decline was attributed to increased costs, depressed world demand, and the increased export of lower priced heavy crude and refined products. Net earnings in 1979 almost doubled, reaching $2.8 billion. The profit gain reflected increases in production, export sales, and prices.

The 1978 year-end estimate of crude oil reserves increased to almost 18.2 billion barrels, and natural gas reserves increased to 42.1 trillion cubic feet. In 1979, the estimate of crude oil reserves increased to over 18.7 billion barrels, and in 1980 is expected to reach 19.4 billion barrels. Natural gas reserves at the end of 1979 were estimated at 44 trillion cubic feet.

The deep Cretaceous drilling in Lake Maracaibo during 1978 and 1979 added light-gravity oil to proved reserves, and younger sediments also contributed significant new reserves. The huge heavy oil deposits of the Orinoco basin will provide additional reserves; the oil-in-place has been conservatively estimated at 700 billion barrels, with some estimates as high as 3 trillion barrels. Recovery factors vary between 5% and 30%, which would conservatively result in some 35 billion barrels of recoverable oil.

Secondary recovery accounts for about one-half of Venezuela's current production. Steam-injection programs have been very successful and constitute a major part of planned secondary recovery projects.

Exploration efforts were underway in several areas: the Maracaibo basin, the Perija area of Zulia, the Gulf of Vela, Gulf of Triste, the Tuy-Cariaco belt near Margarita Island, the Norte-Paria area approaching Trinidad, and the Orinoco River delta.

Lagoven began drilling about 50 miles off the Orinoco River delta in 1978. After three dry holes the company moved north to the Gulf of Paria. In 1979 gas was found at 12,000 feet in a well drilled about 25 miles north of the peninsula. It was estimated that the field may contain 10 trillion cubic feet of natural gas. Further drilling was planned to delineate the size and structure of the field and determine its relationship, if any, to a field in Trinidad. When the company concludes this and other activities in the Gulf of Paria, it plans to return to the Orinoco Delta.

After three dry holes, Corpoven drilled successfully in the Gulf of Vela and anticipated that the area will eventually add significant oil reserves. Corpoven's discovery, located north of the town of Coro, may be related to the old onshore Cumerebo field. The well tested over 2,000 barrels per day of 31° API oil.

After three unsuccessful tests during 1978 and 1979 in the Gulf of Triste, in 1979 Maraven drilled a well between the islands of Margarita and La Tortuga which tested at 1,000 barrels per day of 30° API oil. This discovery was significant in that it established the existence of petroleum in the virtually unexplored Tuy-Cariaco basin. Maraven planned further drilling in this area before returning to the Gulf of Triste.

The Maracaibo basin has been considered the probable southern half of an oil rich area which extends northward into the Gulf of Venezuela. A border dispute with Colombia has, to date, effectively prohibited exploration in the northern area.

Investigations of improved recovery techniques for the heavy metals-rich oil along the Orinoco River continued during 1978 despite some debate as to practicality and priority. World developments in the petroleum sector during 1979 modified the Government's policy towards the Orinoco deposits from one of holding the reserves for future development to one of using the reserves to benefit present economic priorities as well as accomodate increased world demand. To help conserve the light- and medium-grade crude oils, more heavy oil production capability will be developed and sold.

In 1979 PDVSA announced it would invest $2.3 billion over the next 10 years to develop the Orinoco petroleum resources. It was thought that as much as 1 million barrels per day of oil could be produced from this area by the end of this century. Current recovery techniques involving both steam injection and cold production have not been sufficiently tested to provide meaningful comparisons.

Venezuela has a refining capacity of 1.445 million barrels per calendar day, which represents the largest of the Organization of Petroleum Exporting Countries (OPEC) member countries. Refinery outputs were structured to yield about 60% heavy fuel, but market demands have altered and Venezuela is now upgrading the Amuay and

El Palito refineries to include a greater range and quantity of lighter products and to accomodate the input of a wider range of crude oil gravities. The Amuay modifications will cost in excess of $650 million and are scheduled for completion in 1982. The $300 million expansion program for the El Palito refinery will be completed in 1981.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Venezuelan bolivars (Bs) to U.S. dollars at the rate of Bs4.30 = US$1.00.

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The Mineral Industry of Yugoslavia

By Roman V. Sondermayer[1]

During 1978 and 1979, low mineral and metal prices high cost of equipment and supplies, transportation difficulties, labor problems, Government regulations, and lack of capital hampered the activities of the Yugoslav mineral industry, but the sector remained among the most active segments of the economy. Yougoslavia was among the leading mine and smelter producers of nonferrous metals in Europe. The major minerals mined, with production expressed in approximate ranges of percentage of recent world output, were as follows: magnesite 5% to 6%, lead 4% to 5%, bauxite and antimony 3% to 4%, copper and zinc 1% to 2%. Production of other minerals was only of domestic significance. Lignite was again the principal fuel produced in the country. As in the past, imports of liquid fuels and bituminous coal were essential to meet the energy demand of the country. In addition, Yugoslavia became an importer of natural gas in 1978.

During 1978 and 1979, the mineral industry contributed about 10% to the gross social product (GSP), and its share in the industrial labor force ranged between 5% and 6% of the total. Inflation (13% to 20%), unemployment (about 14%), and foreign trade deficit afflicted the country's economy.

During 1978, the major events in the minerals industry included completion of alumina plants near Zvornik, Bosna i Hercegovina (BiH), near Obrovac, Hrvatska (Croatia); construction of an aluminum smelter near Mostar, BiH; completion of a plant for recovery of magnetite at Majdanpek, Srbija (Serbia); completion of construction of a new blast furnace at Zenica (BiH); beginning of construction of a new lead refinery at Zvecan, Serbia; and completion of gas pipelines bringing natural gas from the U.S.S.R. into Yugoslavia. During 1979, major accomplishments of the country's mineral industry were as follows: expansion of Sibenik aluminum plant; construction of aluminum smelter near Mostar; development of an opencast copper mine at Veliki Krivelj, Serbia; discovery of new chromite reserves near Radusa, Macedonia, and start of development of a nickel mine and beginning of construction of a nickel smelter at Glogovac, Serbia; construction of another nickel mine and smelter at Rzanovo, near Kavadarci, Macedonia; and completion of construction of a pipeline between the island of Krk on the Adriatic and inland refineries in Yugoslavia, Hungary, and Czechoslovakia.

PRODUCTION

The size of mining and mineral processing enterprises in Yugoslavia range from large integrated operations with modern technology, mostly in production of metals and petroleum, to small, rather primitive operations, mostly in production of nonmetals.

The mineral industry was State-owned. However, investment of foreign capital in Yugoslavia's industry, including the mineral industry, was permitted provided that Yugoslavia retained ownership of the deposit and a controlling interest in the venture, and that management of the venture be in accordance with Yugoslav laws concerning workers' self-management. The tabulation below lists the major enterprises, with principal facilities, operating in Yugoslavia during 1978 and 1979.

Structure of industry

Commodity	Major companies—principal facilities (all State-owned)
Aluminum	Boris Kidric Tvornica Lakih Metala - smelter at Sibenik, Croatia.
Antimony	RTB Zajaca - smelter at Zajaca; mines at Kopaonik Mountain, Serbia.
Bauxite	Energoinvest - mines at Vlasenica, Bosnia.
Coal, brown	Titov Rudnici (Uglja) - mines at Kreka Banovici Breza, Kakanj, Bosnia.
Copper, metal	RTB Bor-mines at Bor and Majdanpek; smelter at Bor, Serbia.
Lead, smelter	RMK Trepca - mine at Stari Trg; smelter at Zvecan, Serbia.
Lignite	REK Kolubara - mines at Kolubara and Tamnava, Serbia.
Petroleum	INA Naftaplin - oilfields at Benicanci and Struzec; refineries at Rijeka and Sisak.
Steel, crude	RMK Zenica - integrated iron works at Zenica, Bosnia.
Zinc, mine	RMK Trepca - mine at Stari Trg.
Zinc, smelter	Zletovo, Topilnica za Cink i Olovo - Imperial smelter at Titov Veles, Macedonia

Table 1.—Yugoslavia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS				
Aluminum:				
Bauxite thousand tons	2,033	2,044	2,566	[2]3,012
Alumina	455,276	499,341	494,000	900,000
Metal ingot, primary and secondary	197,679	197,457	195,708	[2]189,522
Antimony:				
Mine output, metal content	2,021	2,248	2,760	2,800
Metal (regulus)	2,332	1,024	1,791	[2]2,401
Bismuth, smelter	78	74	13	28
Cadmium, smelter	[r] [e]180	189	[e]185	200
Chromium:				
Chromite ore (domestic production)	2,022	1,546	[e]1,500	1,500
Chromite concentrate (produced largely from imported ores)	34,911	51,331	[e]50,000	50,000
Copper:				
Mine output, metal content	120,130	116,218	123,300	[2]108,000
Blister:				
Primary	[e]99,000	97,397	[e]100,000	100,000
Secondary	[e]65,139	68,426	[e]65,000	52,000
Total	164,139	165,823	[e]165,000	[2]152,000
Refined:				
Primary	121,587	92,977	[e]100,828	92,504
Secondary	14,883	50,539	[e]50,000	45,000
Total	136,470	143,516	150,828	[2]137,504
Gold, refined troy ounces	157,088	164,226	[e]165,000	160,000
Iron and steel:				
Iron ore:				
Gross weight thousand tons	4,269	4,451	4,564	[2]4,617
Fe content do	1,499	1,514	1,597	1,616
Iron concentrate do	1,646	1,726	[e]1,700	1,700
Pig iron do	1,918	1,938	2,081	[2]2,360
Ferroalloys:				
Ferrochrome	42,770	36,150	42,000	50,000
Ferromanganese	22,221	54,639	64,000	75,000
Ferrosilicon	98,668	55,513	64,000	70,000
Silicon metal	([3])	27,476	32,000	35,000
Ferrosilicomanganese	25,848	8,737	10,000	10,000
Ferrosilicochrome	7,123	5,257	6,000	8,000
Other	3,716	1,719	2,000	2,000
Total	200,346	189,491	220,000	[2]250,000

See footnotes at end of table.

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Table 1.—Yugoslavia: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
METALS —Continued				
Iron and steel —Continued				
Crude steel:				
From oxygen converters thousand tons	269	724	1,048	1,071
From Siemens-Martin furnaces do	1,651	1,587	1,494	1,476
From electric furnaces do	831	873	909	990
Total do	2,751	3,184	3,451	[2]3,537
Semimanufactures do	2,440	3,329	4,142	[2]4,140
Lead:				
Mine output, metal content	122,466	129,977	124,500	120,000
Metal:				
Smelter, crude, primary and secondary	140,385	145,041	[e]140,000	130,000
Refined, primary and secondary	111,220	129,890	116,703	[2]111,040
Manganese ore:				
Gross weight	19,000	24,750	27,000	24,000
Mn content	6,550	8,702	9,500	8,500
Mercury 76- pound flasks	12,503	3,133	--	--
Platinum-group metals:				
Palladium troy ounces	NA	4,951	[e]5,100	5,000
Platinum do	NA	739	[e]800	700
Selenium, refined kilograms	45,080	50,360	[e]51,000	50,000
Silver, refined, including secondary thousand troy ounces	4,631	4,679	5,112	[2]5,208
Zinc:				
Mine output, metal content	106,641	112,383	97,400	[2]112,400
Smelter, including secondary	[r]95,469	98,845	92,232	[2]98,906
NONMETALS				
Asbestos	12,830	9,036	10,360	10,500
Barite	56,122	52,245	[e]53,000	50,000
Cement, hydraulic thousand tons	[r]7,620	8,006	8,698	[2]9,081
Clays: Fire clay:				
Crude	[r]331,885	305,171	[e]310,000	300,000
Calcined	78,532	81,949	[e]82,000	80,000
Feldspar, crude	25,386	56,146	[e]57,000	55,000
Gypsum:				
Crude	422,260	482,552	[e]500,000	450,000
Calcined	82,470	96,540	[e]100,000	90,000
Lime:				
Quicklime thousand tons	1,167	1,261	1,470	[2]1,783
Hydrated do	760	786	[e]790	750
Total do	1,927	2,047	2,260	2,533
Magnesite:				
Crude	391,000	345,000	333,000	[2]293,000
Sintered	189,884	164,180	[e]160,000	130,000
Caustic calcined	4,844	8,763	[e]8,000	5,000
Mica, all grades	68	139	[e]140	140
Nitrogen: N content of ammonia thousand tons	387	417	[e]410	410
Quartz, quartzite, glass sand do	1,607	1,931	[e]2,000	NA
Salt:				
Marine	12,881	20,576	[e]20,000	NA
From brines	[r]185,000	188,000	[e]190,000	NA
Rock	91,230	85,210	[e]88,000	NA
Total	[r]289,111	293,786	298,000	[2]350,000
Sand and gravel (except glass sand) thousand cubic meters	14,505	16,163	20,692	[2]26,845
Sodium compounds: Sodium carbonate do	137,232	156,826	166,350	170,000
Stone (except quartz and quartzite):				
Dimension:				
Crude:				
Ornamental do	50	55	NA	NA
Other do	1	6	NA	NA
Partly worked facing thousand square meters	779	934	NA	NA
Cobblestones, curbstones, other thousand cubic meters	[r]32	15	NA	NA
Crushed and broken, n.e.s do	4,034	3,575	NA	NA
Milled marble and other do	4,364	5,529	NA	NA
Sulfur and pyrite:				
Pyrite, gross weight thousand tons	440	394	280	280

See footnotes at end of table.

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Table 1.—Yugoslavia: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity[1]	1976	1977	1978[p]	1979[e]
NONMETALS —Continued				
Sulfur and pyrite —Continued				
Sulfur:				
Content of pyrite thousand tons	[r]185	166	120	120
Byproduct:				
Of metallurgy[e] do.	[r]200	200	200	200
Of petroleum[e] do.	5	5	7	7
Total do.	390	371	327	327
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	[r]21,794	23,284	[e]23,000	22,000
Coal:				
Bituminous thousand tons	586	511	471	[2]434
Brown do.	9,110	8,960	8,855	[2]9,351
Lignite do.	27,149	29,611	30,360	[2]32,329
Total do.	36,845	39,082	39,686	[2]42,114
Coke:				
Metallurgical do.	1,686	1,662	NA	NA
Breeze do.	100	103	NA	NA
Total do.	1,786	1,765	2,070	[2]2,487
Gas:				
Manufactured (city gas only) million cubic feet	[r]8,775	NA	NA	NA
Natural, gross production do.	61,094	66,902	68,334	[2]65,579
Natural gas plant liquids:				
Natural gasoline and pentane thousand 42-gallon barrels	120	100	[e]140	150
Propane and butane do.	607	567	[e]580	600
Total do.	727	667	[e]720	750
Petroleum:				
Crude:				
As reported thousand tons	3,880	3,951	4,076	[2]4,130
Converted thousand 42-gallon barrels	28,739	29,265	30,190	30,687
Refinery products:				
Gasoline do.	16,346	18,964	20,230	[2]22,177
Jet fuel do.	2,517	2,675	[e]2,700	3,000
Distillate fuel oil:				
Diesel do.	22,149	25,737	25,894	[2]29,213
Other do.	1,257	--	--	--
Residual fuel oil do.	31,968	38,748	40,752	[2]43,217
Lubricants do.	1,181	1,552	2,394	3,000
Other:				
Liquefied petroleum gas do.	2,660	3,000	[e]3,100	3,000
White spirit do.	248	272	[e]270	250
Paraffin do.	75	82	[e]70	80
Asphalt and bitumen do.	2,369	3,254	[e]3,300	3,300
Petroleum coke do.	306	337	[e]350	300
Total[4]	81,076	94,621	99,060	107,0[illegible]7

[e]Estimate. [p]Preliminary. [r]Revised. NA Not available.

[1] In addition to the commodities listed, germanium, bentonite, kaolin, common clay, and diatomite are also produced, and tellurium may be recovered as a copper refinery byproduct, but available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

[3] Apparently included with ferrosilicon.

[4] Excludes refinery gas (12,639 million cubic feet in 1976, 15,351 million cubic feet in 1977, and an unreported quantity in 1978 and 1979), as well as other materials produced by and used in the refineries as fuel.

TRADE

During 1978, latest year for which, complete data are available, Yugoslavia was a net importer of minerals, with fuels causing most of the deficit. Imports of minerals, valued at 43.3 billion dinars[2] ($2.5 billion), accounted for 26% of total imports. Fuels, mostly crude oil and bituminous coal, were 51% of mineral imports. Exports of minerals, valued at 14.4 billion dinars ($800 million), were about 16% of total exports. Exports of nonferrous metals accounted for 37% of mineral exports. Tables 2 and 3 show details on foreign trade of Yugoslavia in 1978.

Table 2.—Yugoslavia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite and concentrate ---- thousand tons	909	676	U.S.S.R. 350; Romania 150; Czechoslovakia 126.
Alumina	111,061	79,028	Poland 484; Czechoslovakia 161; U.S.S.R. 145.
Metal including alloys:			
Scrap	6,148	3,127	Italy 2,082; West Germany 846.
Unwrought	64,055	58,730	East Germany 32,071; Czechoslovakia 10,362.
Semimanufactures	49,815	55,055	Czechoslovakia 15,827; United States 9,356; West Germany 5,805.
Antimony, regulus	580	1,485	U.S.S.R. 810; Bulgaria 585.
Bismuth metal including alloys, all forms	2	--	
Cadmium metal including alloys, all forms	101	176	United States 101; Czechoslovakia 62.
Chromium:			
Chromite	3,523	5,710	Czechoslovakia 5,710.
Oxide and hydroxide	10	10	Austria 10.
Copper:			
Copper sulfate	9,464	11,699	Turkey 5,004; China, mainland, 4,395.
Metal including alloys:			
Scrap	14	3,682	Italy 3,130; West Germany 305.
Unwrought	18,741	16,070	United States 11,736; Italy 2,338.
Semimanufactures	28,923	26,711	U.S.S.R. 7,673; Czechoslovakia 3,829; United States 2,368.
Iron and steel:			
Ore and concentrate	--	16,290	East Germany 16,290.
Roasted pyrite	27,674	33,833	Hungary 30,393.
Metal:			
Scrap	42,399	79,288	Italy 69,857; Switzerland 6,272.
Pig iron, ferroalloys, similar materials	181,614	179,381	United States 87,494; Italy 27,446; Austria 25,307.
Steel, primary forms	10,071	16,551	Hungary 15,608.
Semimanufactures:			
Bars, rods, angles, shapes, sections	35,106	87,130	U.S.S.R. 32,342; West Germany 6,148; Poland 5,379.
Universals, plates, sheets	14,003	28,565	West Germany 16,488; Poland 4,650; Austria 3,923.
Hoop and strip	4,549	3,430	Poland 1,861; Italy 839.
Rails and accessories	33,857	27,875	Romania 24,929.
Wire	701	520	Hungary 199; East Germany 162.
Tubes, pipes, fittings	136,128	183,506	China, mainland, 37,149; U.S.S.R. 37,041.
Castings and forgings, rough	8,454	7,598	Poland 3,028; East Germany 1,799.
Lead:			
Ore and concentrate	5,430	39,893	Poland 33,774; U.S.S.R. 4,170; Czechoslovakia 1,949.
Oxides	14	2	U.S.S.R. 1.
Metal including alloys:			
Unwrought	51,540	47,923	U.S.S.R. 27,719; Czechoslovakia 6,479; Austria 6,228.
Semimanufactures	2,239	1,601	France 466; Italy 458; West Germany 376.
Manganese ore and concentrate	3,070	--	
Mercury ---- 76-pound flasks	1,400	--	
Nickel metal including alloys, all forms	302	309	Switzerland 151; West Germany 73; Italy 48.
Platinum-group metals including alloys, all forms: Palladium ---- troy ounces	75,168	66,745	Netherlands 33,887; West Germany 28,550.
Selenium, elemental ---- kilograms	36,000	--	
Silicon	20,419	27,825	U.S.S.R. 9,306; United States 7,443; Romania 2,628.
Silver metal including alloys, all forms thousand troy ounces	2,805	2,182	United States 1,307; Czechoslovakia 412.
Tin metal including alloys, all forms	135	65	West Germany 49; Switzerland 11.
Titanium oxide	13,355	13,453	East Germany 12,839; United States 578.
Zinc:			
Ore and concentrate	NA	2,271	U.S.S.R. 2,271.
Oxide	936	1,270	Romania 880; Hungary 380.
Metal including alloys:			
Blue powder	5,130	--	
Unwrought	41,968	45,241	U.S.S.R. 20,513; Czechoslovakia 17,049.
Semimanufactures	2,942	9,258	Czechoslovakia 4,566; U.S.S.R. 3,479.

See footnotes at end of table.

Table 2.—Yugoslavia: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Other:			
Ash and residue of nonferrous metals	22	28,991	Bulgaria 16,248; Italy 10,147.
Oxides, hydroxides, peroxides of metals, n.e.s	102	87	Sweden 85.
NONMETALS			
Abrasives, natural: Grinding and polishing wheels and stones	2,749	2,773	Romania 1,309; Poland 710.
Asbestos	2,159	1,902	Albania 1,369; West Germany 280; Romania 110.
Barite and witherite	25,309	16,495	Hungary 16,445.
Cement	410,116	326,079	Nigeria 111,010; Tunisia 83,770.
Chalk	6	15	Hungary 15.
Clays and clay products (including all refractory brick):			
Crude:			
Bentonite	38	136	Guinea 136.
Fire clay	5,734	9,975	Italy 8,391.
Kaolin	10,638	9,812	Italy 5,637; Greece 4,171.
Products:			
Refractory (including nonclay brick)	61,777	61,923	Romania 29,275; West Germany 9,786; Poland 5,413.
Nonrefractory	4,812	7,153	Venezuela 4,786; Austria 949.
Feldspar	8,932	7,904	Hungary 4,753; Greece 1,923; Czechoslovakia 1,209.
Fertilizer materials, manufactured:			
Nitrogenous	35,042	72,819	Turkey 50,425; West Germany 14,910.
Phosphatic	159,937	160,263	Hungary 104,901; U.S.S.R. 24,940; Nigeria 19,992.
Other, including mixed	156,245	184,090	Turkey 61,453; Italy 49,334; Hungary 19,948.
Gypsum and plasters	14,354	288	U.S.S.R. 259.
Lime	6,231	27,534	Hungary 16,264; Kuwait 11,193.
Magnesite	[r]29,113	31,348	West Germany 20,184; Italy 4,125.
Pyrite, gross weight	214,214	93,421	Romania 74,664; West Germany 18,757.
Salt and brine	50	54	Hungary 50.
Sodium and potassium compounds, n.e.s	3,024	1,274	France 300; Romania 275; West Germany 212.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	59,715	49,745	Italy 29,115; Czechoslovakia 14,181.
Worked	8,172	6,252	West Germany 4,147; Austria 1,304.
Dolomite, chiefly refractory grade	90	1	West Germany 1.
Gravel and crushed rock	178,915	57,238	Gabon 51,180.
Limestone (except dimension)	4,071	10	West Germany 10.
Quartz and quartzite	8,141	9,767	West Germany 9,467; Greece 300.
Sand, excluding metal bearing	1,570	2,376	Greece 1,584; Albania 755.
Sulfur:			
Elemental other than colloidal	NA	266	Romania 244.
Sulfuric acid	[r]1,737	1,192	Albania 1,154.
Other:			
Crude:			
Calcite	242	2,149	Greece 1,797.
Unspecified	1,130	257	Greece 254.
Slag, dross, and similar waste, not metal bearing	1,779	1,615	Austria 1,554.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	21	55	West Germany 55.
Coal and briquets:			
Anthracite and bituminous coal	NA	940	Romania 940.
Lignite and lignite briquets	217,375	434,929	Austria 216,761, Italy 185,043.
Hydrogen, helium, rare gases ... kilograms	378,301	633,265	Austria 492,280; Italy 108,785.
Peat, including peat briquets and litter	26	25	Italy 25.
Petroleum:			
Crude	(1)	(1)	All to Czechoslovakia.
Partly refined ... thousand 42-gallon barrels	(1)	NA	
Refinery products:			
Gasoline ... do	2,652	3,536	Netherlands 1,777; Switzerland 1,717.
Kerosine and jet fuel ... do	186	395	United Kingdom 101.
Distillate fuel oil ... do	3,088	2,380	Italy 1,380; Switzerland 836.
Residual fuel oil ... do	1,758	306	Italy 280.
Lubricants ... do	14	336	Italy 315.
Other:			
Liquefied petroleum gas ... do	NA	174	Italy 174.
White spirits ... do	[r]34	33	Austria 33.
Mineral jelly and wax ... do	39	39	Italy 16; West Germany 8.
Petroleum coke ... do	55	40	West Germany 39.
Total ... do	[r]7,826	7,239	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	7,950	20,293	Italy 10,225; United States 4,907; France 2,651.

[r] Revised. NA Not available.

[1] Less than 1/2 unit.

Table 3.—Yugoslavia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate thousand tons	51	44	Greece 17; Guinea 11; Australia 9.
Oxide and hydroxide	1,347	30,162	Guinea 29,000.
Metal including alloys:			
Unwrought	43,699	41,590	U.S.S.R. 35,714; Hungary 4,200.
Semimanufactures	13,921	9,538	U.S.S.R. 4,798; West Germany 1,561.
Antimony:			
Ore and concentrate	2,209	2,789	Turkey 800; Australia 604; Morocco 504.
Metal including alloys, all forms	170	145	China, mainland, 145.
Arsenic:			
Trioxide, pentoxide, acids	50	NA	
Metal including alloys, all forms	^{r}21	36	U.S.S.R. 25.
Beryllium metal including alloys, all forms kilograms	323	167	Denmark 104; West Germany 63.
Bismuth metal including alloys, all forms	31	18	China, mainland, 13.
Cadmium metal including alloys, all forms	7	NA	
Chromium:			
Chromite	^{r}225,471	219,069	Albania 126,971; U.S.S.R. 74,840.
Oxide and hydroxide	740	619	United Kingdom 450.
Metal including alloys, all forms	17	NA	
Cobalt:			
Oxide and hydroxide	35	32	Netherlands 10; Belgium-Luxembourg 8.
Metal including alloys, all forms	71	NA	
Columbium and tantalum: Tantalum metal including alloys, all forms kilograms	574	859	West Germany 705.
Copper:			
Ore and concentrate	20,137	23,994	Mexico 13,825; Peru 10,168.
Copper sulfate	1,537	1,553	U.S.S.R. 1,536.
Metal including alloys:			
Scrap	10	(1)	
Unwrought	27,186	39,791	Zambia 25,117; Peru 11,727.
Semimanufactures	^{r}6,670	8,469	Hungary 3,425; U.S.S.R. 1,540; Belgium-Luxembourg 1,293.
Iron and steel:			
Ore and concentrate	515,443	547,006	India 247,168; U.S.S.R. 185,352.
Metal:			
Scrap	409,022	402,594	U.S.S.R. 367,104; Bulgaria 31,866.
Pig iron, including cast iron	17,757	71,612	East Germany 34,880; U.S.S.R. 21,190.
Sponge iron, powder, shot	2,031	2,626	Sweden 2,235.
Ferroalloys:			
Ferromanganese	799	815	West Germany 473; Switzerland 140; Belgium-Luxembourg 126.
Other	7,789	6,584	West Germany 2,163; France 1,476.
Steel, primary forms:			
Blooms, billets, slabs, sheets, bars	621,869	581,773	Czechoslovakia 191,961; Romania 133,849; U.S.S.R. 133,118.
Coils for recoiling	360,085	435,191	Czechoslovakia 117,196; U.S.S.R. 79,076; Bulgaria 72,177.
Semimanufactures:			
Bars, rods, angles, shapes, sections	^{r}185,948	278,601	Hungary 80,503; Romania 33,282; Poland 29,804; Czechoslovakia 18,694.
Universals, plates, sheets	479,226	441,289	Czechoslovakia 111,562; West Germany 82,849; Austria 54,235.
Hoop and strip	102,729	90,270	West Germany 28,927; Poland 18,266; Czechoslovakia 13,322.
Rails and accessories	7,478	7,482	West Germany 5,847; U.S.S.R. 712; Austria 668.
Wire	^{r}57,015	30,145	West Germany 7,623; Austria 4,310; Romania 1,935.
Tubes, pipes, fittings	144,010	88,054	East Germany 17,456; West Germany 10,011; France 9,530.
Castings and forgings, rough	1,258	2,198	Czechoslovakia 624; West Germany 478; France 375; Italy 288.
Lead:			
Ore and concentrate	22	5,623	Greece 4,123; China, mainland, 1,500.
Oxides	2,765	3,084	Bulgaria 1,511; West Germany 698.
Metal including alloys:			
Scrap	2,187	NA	
Unwrought	5,321	8,192	Bulgaria 7,010.
Semimanufactures	51	104	West Germany 104.
Magnesium metal including alloys, all forms	1,430	976	Norway 342; U.S.S.R. 316.
Manganese:			
Ore and concentrate	^{r}126,860	96,346	Gabon 42,242; Switzerland 26,240; U.S.S.R. 16,870.
Oxides	2,606	794	France 320; Belgium-Luxembourg 149; West Germany 122.
Metal	437	NA	
Mercury 76-pound flasks	58	230	China, mainland, 203.

See footnotes at end of table.

Table 3.—Yugoslavia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Molybdenum metal including alloys, all forms	12	18	Austria 10; West Germany 6.
Nickel metal including alloys:			
Scrap	135	10	Switzerland 10.
Matte, speiss, similar materials	193	108	Netherlands 108.
Unwrought	234	238	Hungary 99; West Germany 51; Sweden 40.
Semimanufactures	507	430	West Germany 320.
Platinum-group metals including alloys, all forms:			
Platinum troy ounces	1,929	71,375	West Germany 64,655.
Palladium do.	79,766	NA	
Rhodium do.	129	NA	
Other do.	[r]932	NA	
Silver metal including alloys thousand troy ounces	7,779	1,475	Austria 547; West Germany 389; Poland 286.
Tellurium, elemental kilograms	505	NA	
Tin:			
Oxides	17	13	West Germany 12.
Metal including alloys:			
Unwrought	1,960	1,833	China, mainland, 1,779.
Semimanufactures	25	36	West Germany 21; Italy 15.
Titanium:			
Ore and concentrate	47,305	45,980	Australia 45,482.
Oxides	2,853	2,578	France 1,126; West Germany 967.
Metal including alloys, all forms	43	NA	
Tungsten metal including alloys, all forms	18	23	China, mainland, 7; Austria 5; Netherlands 3.
Zinc:			
Ore and concentrate	33,641	33,465	Peru 16,510; North Korea 13,954.
Oxides	676	227	West Germany 223.
Metal including alloys:			
Unwrought	14,127	4,794	Zambia 2,203; Poland 1,979.
Semimanufactures	85	74	Italy 39; France 20; East Germany 14.
Zirconium metal including alloys, all forms	3	NA	
Other:			
Ores and concentrates:			
Of vanadium, tantalum, zirconium	1,691	2,117	Australia 961; Hungary 750; West Germany 403.
Ash and residue containing nonferrous metals	572	1,614	Switzerland 1,183.
Oxides, hydroxides, peroxides of metals, n.e.s.	988	1,222	West Germany 890; U.S.S.R. 100.
Metals including alloys, all forms:			
Metalloids	[r]74	NA	
Alkali, alkaline earth, rare-earth metals	342	230	France 210.
Pyrophoric alloys	(1)	33	Poland 30.
Base metals including alloys, all forms, n.e.s	3	615	Netherlands 101; West Germany 73; United Kingdom 73.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	303	505	Denmark 184; Hungary 154; Italy 84.
Grinding and polishing wheels and stones	1,233	793	Austria 322; Italy 141; Poland 108.
Asbestos	57,032	47,797	U.S.S.R. 27,037; Canada 11,944.
Barite and witherite	1,110	1,206	West Germany 1,030.
Boron materials:			
Crude natural borates	24,930	28,736	United States 20,856; Turkey 7,500.
Oxides and acids	731	372	U.S.S.R. 337.
Bromine	15	12	West Germany 6; Austria 5.
Cement:			
Portland thousand tons	[r]601	552	U.S.S.R. 208; Hungary 161; Czechoslovakia 9 Bulgaria 75.
Other do.	97	89	Bulgaria 55; Italy 23; Austria 11.
Chalk	[r]3,184	2,383	France 1,594; Austria 606.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Bentonite	759	16	Italy 12; Austria 3.
Fire clay	25,803	35,610	Czechoslovakia 32,884.
Fuller's earth, Dinas earth, chamotte	4,086	5,442	Poland 4,230; Czechoslovakia 888.
Kaolin	67,062	73,464	Czechoslovakia 38,416; East Germany 11,052.
Other	2,903	8,660	Czechoslovakia 7,292; West Germany 499; Poland 302.
Products:			
Refractory (including nonclay brick)	50,980	40,928	West Germany 10,420; France 7,654; United States 6,479.
Nonrefractory	37,272	27,487	Italy 8,098; Czechoslovakia 8,054; Romania 4,354.
Cryolite and chiolite	1,127	120	Denmark 120.
Diamond:			
Gem, not set or strung carats	80,000	100,000	West Germany 45,000; United Kingdom 25,000.
Industrial do.	736,645	35,000	Switzerland 20,000; United Kingdom 10,000.
Powder do.	408,330	130,000	Switzerland 65,000; United States 25,000; United Kingdom 20,000.

See footnotes at end of table.

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Table 3.—Yugoslavia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Diatomite and other infusorial earth	87	152	Austria 94; Sweden 20; Switzerland 14; Denmark 10.
Feldspar	1,189	1,001	France 998.
Fertilizer materials:			
Crude, phosphatic thousand tons	1,066	903	Togo 470; Morocco 169.
Manufactured:			
Nitrogenous	126,139	210,581	U.S.S.R. 98,604; Hungary 39,382; Czechoslovakia 39,000; Bulgaria 23,846.
Phosphatic	44,220	47,089	Tunisia 45,856.
Potassic	378,732	443,173	East Germany 223,707; U.S.S.R. 195,161.
Other, including mixed	28,855	97,361	Poland 52,748; Romania 24,210; United States 17,470.
Ammonia	82,930	65,908	Hungary 43,902; U.S.S.R. 13,675.
Fluorspar	6,861	3,140	East Germany 1,421; France 1,099.
Graphite, natural	1,806	1,812	Austria 690; Czechoslovakia 418; East Germany 350.
Iodine	41	28	Japan 21.
Magnesite	^{r}21,582	27,671	Greece 12,418; Turkey 11,826.
Mica:			
Crude, including splittings and waste	523	716	India 400; Norway 216.
Worked, including agglomerated splittings	133	144	Austria 56; Czechoslovakia 35.
Pigments, mineral:			
Natural, crude	70	NA	
Iron oxides, processed	2,096	4,506	Hungary 1,630; West Germany 966; Czechoslovakia 660.
Precious and semiprecious stones, except diamond:			
Natural kilograms	21	61	West Germany 59.
Manufactured do	491	483	Austria 313.
Pyrite, gross weight	72,625	19,126	U.S.S.R. 19,094.
Quartz, piezoelectric kilograms	400	NA	
Salt and brine	158,055	149,216	Romania 103,969.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	128,552	206,639	France 69,695; Italy 53,262; Romania 25,392; Poland 22,160.
Caustic potash and sodic and potassic peroxides	197	120	Romania 86; Czechoslovakia 33.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	9,620	193	Mainly from Italy.
Slate	170	374	France 300.
Other	2,281	1,503	Italy 918; Sweden 460.
Worked	60	197	Italy 187.
Dolomite, chiefly refractory grade	1,457	947	Austria 782; Italy 103.
Gravel and crushed rock	113,921	168,902	Hungary 168,090.
Limestone (except dimension)	47,616	63,391	Hungary 59,805.
Quartz and quartzite	12,069	18,323	West Germany 7,647; Greece 9,404.
Sand, excluding metal bearing	^{r}116,449	98,159	Italy 32,222; East Germany 23,201; Hungary 20,500.
Sulfur:			
Elemental, all forms	1,852	1,763	Italy 1,442.
Sulfur dioxide	547	300	Italy 300.
Sulfuric acid	102,074	84,857	Hungary 67,212; West Germany 9,984.
Talc, steatite, soapstone, pyrophyllite	3,261	5,127	West Germany 2,534; Italy 781; France 727.
Other nonmetals, n.e.s.:			
Crude	13,331	14,127	Hungary 11,485.
Slag, dross, and similar waste, not metal bearing	^{r}240,305	389,622	Italy 290,940; Romania 98,195.
Oxides and hydroxides of magnesium, strontium, barium	4,291	1,622	Norway 1,109.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	7,268	6,610	Romania 5,906.
Carbon black and gas carbon	11,600	16,971	Italy 12,235; West Germany 2,739.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	2,604	1,674	U.S.S.R. 1,112; Czechoslovakia 342; United States 82.
Briquets of anthracite and bituminous coal do	6	1,379	U.S.S.R. 883; Czechoslovakia 283.
Lignite and lignite briquets	224,527	161,413	East Germany 114,787; U.S.S.R. 46,131.
Coke and semicoke thousand tons	175	97	Poland 66; Italy 12.
Hydrogen, helium, rare gases kilograms	25,322	143,557	Italy 132,926.
Peat, including peat briquets and litter	6,057	16,518	U.S.S.R. 7,201; Hungary 4,812; Poland 4,467.
Petroleum:			
Crude thousand 42-gallon barrels	^{r}71,540	76,973	Iraq 37,619; U.S.S.R. 30,142.
Partly refined do	21	--	

See footnotes at end of table.

Table 3.—Yugoslavia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum —Continued			
Refinery products:			
Gasoline — thousand 42-gallon barrels	[r]198	469	Hungary 307; Romania 105.
Kerosine and jet fuel do	124	463	U.S.S.R. 355.
Distillate fuel oil do	[r]3,463	1,788	U.S.S.R. 1,780.
Residual fuel oil do	3,510	6,398	U.S.S.R. 3,607; Romania 1,568.
Lubricants do	[r]205	916	U.S.S.R. 362; Romania 213; Italy 163.
Other:			
Liquefied petroleum gas do	[r]1,013	2,498	U.S.S.R. 1,310; Hungary 665; Bulgaria 315.
Mineral jelly and wax do	[r]43	36	Bulgaria 12; Hungary 7; West Germany 6.
Nonlubricating oils, n.e.s do	[r]472	--	
Bitumen and other residues, n.e.s do	[r]14	18	West Germany 7; France 6.
Petroleum and pitch coke do	[r]583	447	United States 133; U.S.S.R. 131; Albania 105.
Total do	[r]9,625	13,033	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	32,949	46,952	Italy 19,064; U.S.S.R. 10,221.

NA Not available. [r] Revised.

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—Completion of one alumina plant, construction of one aluminum smelter, and expansion of another one were the principal events of the aluminum industry of Yugoslavia during 1978 and 1979.

During 1978, a 600,000-ton-per-year alumina plant, using U.S.S.R. technology, started production at Birac, near Zvornik, BiH; designed capacity should be reached in 1980. Energoinvest of Sarajevo, BiH, was the investor. Total investments by the State-owned Energoinvest were reported at 6.7 billion dinars (about $330 million) of which the U.S.S.R. provided $130 million, mostly used for purchasing equipment made in the U.S.S.R. For a period of 10 years all alumina from Birac will be shipped to the U.S.S.R. as repayment of the credit. The contract between Energoinvest and the U.S.S.R. for credit and technical assistance, signed in 1972, was the first direct loan granted by the Government of the U.S.S.R. to a Yugoslav enterprise. Bauxite for the new plant will be trucked from Energoinvest's bauxite mines some 60 kilometers away. The Birac plant has its own plant for power and steam production, providing about 40% of the total. Fuel was initially residual fuel oil, but it will be replaced with natural gas. In 1979 the gas pipeline connecting gas fields in Vojvodina, Serbia, and in Hungary and the U.S.S.R. with consumers in Zvornik and other parts of Yugoslavia went onstream.

Energoinvest of Sarajevo was the largest producer in Yugoslavia of bauxite and alumina. During 1978 and 1979 Energoinvest continued construction on a 92,000-ton-per-year aluminum electrolytic plant at Bacevici near Mostar, BiH, due for completion in 1980; expansion of the Sibenik aluminum plant, operated by the Tvornica Lakih Metala Boris Kidric enterprises, to a capacity of 100,000 tons per year also continued. In addition, a secondary aluminum plant with a capacity of 15,000 tons per year was completed nearby, at Lozovac, in 1978.

Copper.—During 1978 and 1979, the copper industry continued to expand mining facilities and metal processing installations. Rudarsko Topionicki Bazen Bor (RTB Bor), Bor, Serbia, was the only smelter producer of copper in Yugoslavia. A new opencast mine developed on ore body "X", which started trial production during 1977, began regular production in April 1978, at a rate scheduled to reach 250,000 tons of ore per year. The new ore body will extend the life of the surface operations at Bor for another 6 years.

Expansion of the electrolytic plant at Bor continued; when completed in 1980 capacity will be 180,000 tons of copper per year. A 100-ton-per-day oxygen plant was commissioned at Bor in the fall of 1978; use of oxygen was expected to increase smelting capacity by 23,000 tons per year without additional smelting facilities. Plans were also completed for construction of a new

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plant to produce sulfuric acid from pyrite in the ore and from the smelter gases. Steam for electric power generation will also be recovered.

At Majdanpek (part of the RTB Bor) a plant to recover 120,000 tons of magnetite from the tailing started production in 1978. A factory for production of 15,000 tons of copper pipes, ranging in diameter from 6 millimeters to 76 millimeters, was commissioned by Bor at the village of Debeli Lug and went onstream, also in 1978. Initial production was exported principally to England and France.

During 1978 and 1979 at Veliki Krivelj, in the general area of Bor and Majdanpek, eastern Serbia, RTB Bor started development of a new opencast mine and mill, to cost half a billion dollars. About 20 million tons of overburden was to be removed before ore production started. After a large exploration program, the ore body was estimated at 250 million tons containing about 0.42% copper. Plans called for annual production of 25,000 tons of copper in concentrates, 240,000 tons of pyrite concentrates, 50,000 tons of magnetite concentrates, 250 tons of molybdenum concentrates, and undisclosed quantities of gold, silver, and selenium.

To finance the purchase of mining and metallugical equipment for Bor and Veliki Krivelj, the Bank of Japan granted a 7-year, $10 million credit to Yugoslavia; there was no commitment for repayment in commodities.

The copper mine and mill at Bucim, Macedonia, started production in 1979. Three ore bodies, Cukar, Vrsnik, and Bucim, are present; the tabulation below shows annual planned output and length of production for each of these:

Product	Unit	Cukar (3 yr)	Vrsnik (4 yr)	Bucim (13 yr)
Ore	million tons	3.7	5.4	7.2
Concentrates	tons	200,322	113,750	107,712
Copper content	tons	21,027	23,983	21,669
Gold	kilograms	463	695	950
Silver	kilograms	846	1,802	2,400
Iron concentrates	tons	--	--	108,000
Planned date for last production	--	1982	1986	1999

Chromite.—New reserves of chromite were discovered near Radusa, an old and exhausted chromite mine in Macedonia. Reportedly over 1 million tons of chromite were located. Grade of ore and date of startup of production were not made public. It should be noted that at Radusa mine site a chromite upgrading plant was in operation processing imported ores. Consequently new reserves will need only capital for development of a mine.

Gold.—In 1978, Jugohrom, a producer of ferroalloys at Jegunovce, Macedonia, announced a discovery of gold in the vicinity of the town of Krusevo, Macedonia. During 1979, exploration was underway in the area, but at yearend results were not made public.

In large gravel deposits near Bela Crkva, Vojvodina, Serbia, minor quantities of gold were found. Because the deposits are large, Geozavod of Belgrade was asked to determine whether profitable production of gold would be possible.

Gold was produced in Yugoslavia as a byproduct of copper production at Bor and of lead-zinc production at Trepca.

Iron Ore.—Exploration for and production of iron ore was limited to iron ore provinces in Bosnia, BiH, and western Macedonia during 1978 and 1979.

The Radovan Iron Ore Mine, in Bosnia, BiH, was preparing to open new mines at the locality of Tovarnica, near Jablanica, and Razevica in the general area of the town of Gornij Vakuf, both in Bosnia; when these become fully operational, the Radovan complex should produce 500,000 tons of iron ore per year.

In 1978, discovery of a new iron ore deposit was announced near the village of Tevanovici in the iron ore province of Ljubija, in Bosnia, BiH. Preliminary results indicated 2 million tons of iron ore with an average content of iron of 50%. During 1979, exploration continued on the Tevanovici deposit. Results confirmed preliminary results.

In 1978, production of magnetite started in a 120,000-ton-per-year magnetite plant at Majdanpek, Serbia, operated by RTB Bor. Magnetite is a byproduct of copper mining at Bor and Majdanpek. RTB Bor was planning to build a plant for processing iron cinders left after production of sulfuric acid. Reportedly Bor should have facilities to deliver about 800,000 tons of iron cinder and magnetite annually to Smederevo Iron & Steel works by 1985, if financing is assured.

A new mine to produce 2 million tons of iron ore per year, later to be expanded to 4 million tons, was to be built at Omarska, Bosni, BiH, where large reserves of ore containing 48% iron have been proven.

Yugoslavia was a net importer of iron ore in 1978, latest year for which data were available, but domestic production supplied almost 88% of the country's demand; the largest domestic iron mines were operated by RMK Zenica at Vares and Ljubija, BiH.

Principal suppliers of foreign iron ore were India and the U.S.S.R.

Iron and Steel.—Production of steel in Yugoslavia reached an alltime high of 3.5 million tons, but imports of semimanufactured products were still required. Expansion of RMK Zenica in Bosnia, the leading producer, continued during 1978 and 1979. The fourth blast furnace, which increased pig iron output by 700,000 tons per year, went onstream in November 1978. A 750,000-ton-per-year coking plant will start production in 1980, completing the second stage of expansion, and Zenica then should produce 2.3 million tons of steel per year.

In the Boris Kidric plant near Niksic, Montenegro, a new 400,000-ton-per-year blooming mill, imported from Czechoslovakia, started production during 1978. A 126,000-ton-per-year cold-rolling strip mill started production at Ramici, near Banja Luka, BiH; 13-centimeter strip can be rolled to thicknesses between 0.15 and 4 millimeters.

During 1978 and 1979, RMK Zenica was the largest integrated steel plant in the country. The enterprise employed about 37,000 persons and shared 37% in the total output of steel in Yugoslavia.

Lead and Zinc.—During 1978, a new mine, operated by Veliki Madjan, started production at Tisovik near Osecina, Serbia, at a rate of about 1,500 tons of lead in ore per year. Because of the high lead content of the ore (30% to 45% Pb), it was shipped to the smelter at Trepca without concentration. Proven reserves were reported to be enough for 10 years of operation. Employment was about 50 persons. Furthermore, Energoinvest decided to develop the Veovaca mine and a flotation plant based on a lead and zinc deposit on Zvijezda Mountain, near the Vares iron ore mine about 50 kilometers northwest of Sarajevo, BiH. An annual output of 400,000 tons of ore was planned, and annual production should reach 9,000 tons of lead concentrates, 10,000 tons of zinc concentrates, 65,000 tons of barites, and 25 tons of silver. Energoinvest planned to invest about 253 million dinars ($14 million). During 1978 and 1979, several mines and mills had expansion underway; Trepca's program, which was implemeted during the 2-year period, was the most important. The annual capacity of Trepca mine was to increase from 650,000 tons to 1 million tons of ore, output of lead concentrates from 40,000 tons to 65,000 tons, and production of zinc concentrates from 35,000 tons to 56,000 tons. In addition, Trepca's output of bismuth should reach 70 tons and that of cadmium 100 tons. A new ventilation shaft was completed, preparation of levels 10 and 11 was underway, planning for startup of production in the opencast mine at Zijaca was underway, and construction of a 1.5-million-ton-per-year mill at Tunnel 1 continued. In addition, work started on a new 170,000-ton-per-year lead refinery. To abate pollution, the new lead refinery will have a chimney 320 meters high.

The Trepca combine of Kosovska Mitrovica, Serbia, commenced expansion at the Kopaonik lead and zinc mill at Leposavic, located northwest of Kosovska Mitrovica, Serbia. A new circuit for annual recovery of 65,000 tons of pyrite will be added, and crude ore mill capacity was to be increased from the present 420,000 tons to about 500,000 tons of ore per day by the end of 1980.

At the Kisnica and Novo Brdo Mines, located near Pristina, Serbia, reconstruction included a new aerial tramway, deepening of the shaft at Badovac and a ventilation shaft in Ajvalija, and modernization of the opencast mine. The completion data has not been announced.

During 1979, about 21 mines and 14 flotation plants were operational. Two lead smelters (Trepca-Zvecan and Mezica) and one lead refinery (Trepca-Zvecan) produced lead. In addition, one Imperial smelting plant (Titov Veles) produced lead and zinc, and two zinc electrolytic plants (Sabac and Kosovska Mitrovica) produced zinc.

RMK Trepca was the largest lead-zinc producer in the country. Among other facilities, Trepca operated the largest lead and zinc mine, Stari Trg, the largest lead smelter and refinery, Trepca-Zvecan, and the zinc electrolytic plant at Kosovska Mitrovica.

Nickel.—During 1978 and 1979, development continued on Feni's mine and ferronickel plant at Rzanovo near Kavadarci, Macedonia, and at Glogovac in Kosovo and Metohija, Serbia, development started on a mine and ferronickel smelter with an annual capacity of 12,000 tons of nickel in ferronickel. The Rzanovo facility consists of a mine and nickel plant which incorporates a concentrator and a ferronickel smelter. At the underground mine, the cut-and-fill min-

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ing method was adopted, and the first ore was mined during 1979. In addition, the 25-mile-long conveyor belt, the longest in Europe, connecting the mine and plant was near completion at yearend 1979. The conveyor consists of nine continuous section; the longest (more than 12 miles) follows the rugged mountain terrain and passes through a tunnel. The belt, 24 inches wide, is steel-reinforced Goodyear Flexsteel belt. It was designed to operate at temperatures ranging between 0°F and 108°F. It is expected that the conveyor will move about 20 million tons of ore during 10 years of operation. The long conveyor belt system was chosen because its construction cost was lower then the cost of a comparable truck and rail system. At the Rzanovo plant the construction of the concentrator, made of a dry magnetic separator and wet magnetic seperator, was delayed because of late deliveries of equipment during 1979. According to the plan, the dry magnetic separation will produce 1.176 million tons of FeNi concentrate and 1.086 million tons of magnetic ore. Supposedly wet magnetic separation will be used to separate the magnetic portion of the concentrates. At design rates the concentrator should produce 1.720 million tons of nickel concentrates and 0.548 million tons of iron concentrates. The concentrating process produces a fine powder which must be pelletized before being fed to the furnace. The nickel concentrate is easily pelletized only by adding water due to its high talc content.

At the nearby smelter the pellets are then fed to electric furnaces. The recovered nickel accumulates in the metal bath as ferronickel. To meet specifications it has to be desulfurized. The desulfurizing process is divided into two steps. The first step is carbonizing by adding coke to the metal and increasing the carbon content in order to remove oxygen and provide the reducing conditions for desulfurization. The second step is desulfurization by blowing in calcium carbide with nitrogen to remove sulfur as slag. The desulfurized ferronickel is charged into an oxygen blown furnace where excess carbon and silicon will be eliminated and enough iron oxidized so that the content of nickel will increase to 25%. The plant will be completed in 1981, and overall recovery of nickel is expected to be 78%.

At Glogvac, after 15 years of delays and unsuccessful attempts to start development of a mine and a ferronickel plant, all preliminaries, like planning and financing, were completed and actual work on mine development started in 1979. The operating enterprise was named Feronikl and was organized by Rudarsko-Energetski Kombinat Kosovo, one of the largest energy-producing organizations in the country. Financing and equipment deliveries were arranged through contracts with the U.S.S.R., Poland, The Federal Republic of Germany, Japan, Denmark, Norway, and the United States. However, most of the financing has been arranged by a syndicate of Japanese and European investors, represented by Daiwa Security Co., which agreed to provide a total of $120 million to Yugoslavia's Jugobanka for the nickel project and expansion of a coal mine. The loan is for 10 years at interest which is 7/8% higher than the interest paid on 6-month deposits in London. The mine and smelter should have an annual capacity of 12,000 tons of ferronickel when completed in 1983 or 1984. Because of its early stage of development, technical details of the Glogovac operation were lacking at yearend 1979.

Tungsten.—Recent low-keyed exploration for tungsten ore in Serbia had determined several regions where tungsten ore was found. Five, Blagojev Kamen, in the vicinity of Bosiljgrad, the region of Breanica and Bistrica, Stara Planina, and areas on Kopaonik Mountain, all in Serbia, were the most promising. The State of Serbia decided to firm up tungsten reserves by 1980 at a cost of 21 million dinars.

Demand for tungsten has been met by imports since production in Yugoslavia ceased in 1964.

Other Metals.—Yugoslavia also produced bismuth, chromite, germanium, manganese, platinum, palladium, selenium, and silver during 1978 and 1979. Bismuth was a byproduct of lead and zinc output at Trepca, Serbia, and at Titov Veles in Macedonia; cadmium was produced as byproduct at Trepca's plant at Kosovska Mitrovica in Serbia, and at Titov Veles in Macedonia. The Bor complex in Serbia yielded germanium, platinum, and selenium as a byproduct of copper. Manganese was produced in Bosnia. Trepca was the main source of silver, a byproduct of lead and zinc processing.

NONMETALS

Asbestos.—At the Korlace asbestos mine near Raska, Serbia, plans were made for building a new asbestos separation plant with a capacity to process 200,000 tons of ore per year by 1980.

Yugoslavia remained a modest producer of asbestos (slightly over 300,000 tons of ore yielding about 10,000 tons of fiber). Three mines were in operation during 1978 and 1979. Two were in Serbia, and one was in BiH. The Bosna-Asbest Mine, near Bosanski Petrovac in BiH, was the largest producer of asbestos ore and fiber in Yugoslavia and accounted for 44% of ore output and 57% of fiber production of the country. Yugoslavia remained a net importer of asbestos, and imports supplied about 86% of the country's demand in 1978. The U.S.S.R. was by far the major supplier.

Barite.—At Licko Cerje, near Gracac, Croatia, a new 70,000-ton-per-year barite plant started trial production in December 1978. Most of the barite-producing enterprises in Yugoslavia are modest, and the Government of the State of Croatia, with three producing mines, remained the largest producer of barite in the country.

Cement.—Although domestic output was at an alltime high in 1978 and 1979, cement shortages delayed some construction in the country.

During 1978 a new 600,000-ton-per-year cement plant started production in Kakanj, BiH. The plant was designed for rapid expansion, but no decision to expand has yet been made. Expansion of the Popovac plant, Serbia, to 1 million tons continued. In addition, a decision was made to increase annual capacity of the cement plant in Kosjeric, Serbia, by 650,000 tons by 1980. Construction of a 600,000-ton-per-year cement plant in Nasice was delayed, and completion was expected in 1980.

In spite of cement shortages, a 200,000-ton-per-year cement plant at Gorazde, operated by the Azot Chemical Combine, lost 13 million dinars during 1977. During 1978 a special commission was studying problems at Gorazde; at yearend no report were made public on the future of the plant, but closing was mentioned as a possibility. Apparently no reports on the status of the Gorazde cement plant were released during 1979.

During 1979, 21 cement plants were in operation: the largest was a 1,750,000-ton-per-year cement plant at Beocin, Vojvodina, Serbia, operated by Beocinska Fabrika Cementa.

Gypsum.—The Japra gypsum mine at Bosanski Novi, which was a unit of the Beocinska Fabrika Cementa cement factory, was to expand its facilities from 200,000 to 500,000 tons of crude gypsum per year, equivalent to about 60,000 tons of final product. This plan was mostly based on 11 million tons of new gypsum reserves recently confirmed between Bosanski Novi and Svodna. In addition to gypsum, dolomite output was planned to reach 700,000 tons per year based on 2 billion tons of reserves at Blatna, BiH.

Four enterprises produced burnt gypsum in Yugoslavia during 1978 and 1979. Two of them, located in BiH, accounted for slightly over half of the country's output.

Lime.—During 1978 and 1979, construction continued on a lime plant at Drnis, Croatia. Announced capacity was 100,000 tons of lime per year.

Yugoslavia was self-sufficient in lime and has extremely high reserves of limestone. The industry was scattered throughout the country, and producing facilities ranged from primitive to modern. Large quantities of lime were also produced by homeowners in villages, but production was not reported.

Magnesite.—After authorities at Bar, Montenegro, a port on the Adriatic, granted conditional permission for construction of an installation for production of sinter magnesite from seawater and dolomite in 1977, debate continued on the environmental impact of the factory on tourist areas along the Adriatic Sea. However, during 1978 Magnohrom of Kraljevo and representatives of Polish enterprises signed an agreement to finance construction of a 100,000-ton-per-year plant, to start in 1982. About 40% of the output will be used to repay the Polish credits.

At the Vencacki Rudnici i Industrija Mermera Mines, at Arandjelovac, Serbia, expansion should double present output of marble slabs by 1980.

At Svileuva, Serbia, discovery of a new marble deposit was announced, and a decision by local inhabitants was made to start a quarry.

Salt.—The Bajo Sekulic marine salt plant in Ulcini, Montenegro, completed construction of a salt refinery with a capacity of 240 tons per day. Equipment was purchased in Italy. The refinery started operation in 1979 after trial output in 1978, but an earthquake severely damaged the plant in 1979.

Silicon.—Near Bosiljgrad, Serbia, reserves of 40 million tons of quartz sand were established, and an opencast mine started production at a rate of 100 tons per day. All production was sold to Electrobosna, Jajce, BiH, one of the major producers of ferroalloys in the country.

Near Pula, Croatia, the Mikrosil mining

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enterprise took over the operation and debts of the former Istarski Rudnici Nemetala enterprise and started production of very fine quartz sand. An output of 60,000 tons was planned for 1979, and reserves were reportedly high.

Stone.—The Pomoravlje construction enterprise of Svetozarevo, Serbia, and the Venčac mining enterprise of Arandjelovac, Serbia, agreed to jointly develop deposits of onyx near Lozovik, a village near Svetozarevo, Serbia. Estimates by local experts set onyx reserves at over 700,000 cubic meters. During 1979, about 12 million dinars was invested in facilities to produce about 1,000 cubic meters of onyx per year.

In 1978, the Opalska Breca mining enterprises of Kumanovo, Macedonia, received a credit of 32 million dinars to develop a travertine quarry and build a plant for cutting travertine into blocks and slabs. The plans call for a quarry output of 3,500 cubic meters of travertine block and a plant capacity of 2,000 cubic meters of slabs.

Marble.—After several years of exploration in the general area of Kicevo, Macedonia, marble was identified in two localities, Cer and Kamni Most. Reserves at Cer were set at 680,000 cubic meters of marble, which should yield about 102,000 cubic meters of marble blocks; at Kamni Most, reserves were reported at 250,000 cubic meters that could yield about 28,000 cubic meters of marble blocks. At Cer, an opencast mine went onstream during 1978, and a new marble-cutting facility was soon to have an annual capacity of 5,000 cubic meters of marble blocks and 60,000 square meters of marble slabs.

New equipment was installed in the marble-cutting facilities at the Kosmaj mine near Mladenovac, to increase annual output of marble slabs from 55,000 square to 70,000.

MINERAL FUELS

During 1978 and 1979, domestic low-rank coals remained the principal source of energy, and Yugoslavia was dependent on import of high-rank coals and crude oil.

Coal.—Although financial difficulties persisted, production of coal, mostly lignite and brown coal, was among the most active sectors of the mineral industry of Yugoslavia. An alltime high output of coal in the country reflecting a decision to revert to domestic coal as a major fuel for generating electric power in the future.

In Serbia, the largest coal-producing State in Yugoslavia, new coal development was focused on Kolubara and Kosovo. During 1978, in the Kolubara basin, approximately 60 kilometers southwest of Belgrade, Kolubara Rudarsko Energetsko Industrijski Kombinat continued development of the Tamnava low-grade lignite (1,800 kilocalories per kilogram) opencast mine, and 1979 production started. Output of 18 million to 20 million tons of lignite per year is to be reached sometime between 1980 and 1985. Most of the production will be used by several powerplants situated and to be built near Obrenovac.

In the Kosovo lignite basin, near Pristina, Serbia, Rudarsko Energetsko Hemijski Kombinat Kosovo continued work on construction of two power generating units, capacity 339 megawatts each, situated near Obilic. Work was started on expanding Belacevac mining field to increase production from 5.5 million tons to 10 million tons to meet increased demand in nearby powerplants.

At the Kostolac lignite basin, development of the 2.5-million-ton-per-year Cirkovac opencast mine is nearing completion. When completed in 1980, the mine should produce 2.5 million tons of lignite.

Coke.—The coking plant at Bakar started production in the spring of 1978; capacity was reported at 850,000 tons of coke per year from imported coal, but the plant design allows for a second battery of coke ovens of the same capacity. The Sisak iron and steel works will consume the entire output. Excess gas will be delivered to the thermal powerplant at Urinj.

Petroleum and Natural Gas.—In 1978, annual crude oil production went over the 4-million-ton mark for the first time, although only about 30% of refinery throughput was met by domestic output, and imports from Iran, Iraq, and the U.S.S.R. were essential to meet demand.

In 1978, upon completion of the natural gas pipeline system in western Yugoslavia, natural gas from the U.S.S.R. started to arrive, mostly at facilities in Slovenia and Croatia.

Industrija Nafte-INA, headquartered in Zagreb, Croatia, and Naftagas, headquartered in Novi Sad, Serbia, remained the only producers of oil and natural gas in the country. At the end of 1979, six petroleum refineries, three operated by INA (Rijeka, Sisak, and Lendava), two by Naftagas (Novi Sad and Pancevo), and one by Energonvest (Bosanski Brod), had a total installed capacity of 23 million tons.

Exploration, Development, and Pro-

duction.—INA drilled about two-thirds of the approximately 400,000 meters of holes drilled in Yugoslavia during 1978 and 1979. Exploration was conducted onshore in the Pannonian Basin and offshore along the Adriatic coast.

During 1978 and 1979, the Pannonian Basin remained the principal area of exploration for oil and gas and the only oil- and gas-producing province in the country. INA's major discovery was the Molve gasfield, near the town of Koprivnica, Croatia, containing gas reserves equal to all previously known reserves in Croatia (20 billion cubic meters). The Adriatic coast of Yugoslavia remained the only promising sedimentary basin with possibilities for oil and gas from offshore fields in the same basin. INA's major exploration effort was onshore and offshore on the Adriatic coastline. One discovery of natural gas was announced on an offshore well 50 kilometers west of the town of Pula, Istria, and two wells, one on Brac Island and the other in the Gulf of Trieste, were drilling below 5,000 meters.

Naftagas, during 1978 and 1979, continued exploration in Serbia proper and in Vojvodina, the only oil- and gas-production area in Serbia. Several discoveries of natural gas were announced, but details about the size of the new field were lacking.

Production of oil and gas in Yugoslavia came from deposits in the Pannonian Basin. Naftagas commissioned the Coka field in Banat; it should peak at 100,000 tons of crude per year. Benicanci in Croatia remained the largest oilfield in the country; it was operated by Naftaplin, a division of INA.

Refining.—During 1978 and 1979, construction continued on a refinery near Skopje (2 million tons of crude oil per year), Macedonia, which is designed to process heavy crude from Iran. The U.S.S.R. is providing equipment and technology.

Transportation.—The natural gas pipeline system in western Yugoslavia was completed during 1978. The system is about 340 miles long and supplies 26 towns in Slovenia and Croatia with gas from the U.S.S.R. and from local fields. In addition to distribution lines, the project includes 340 miles of 16- to 20-inch transmission lines and will have a total capacity of 2.5 million cubic meters of natural gas per day.

In eastern Yugoslavia, construction continued on another gas pipeline passing through Vojvodina and in Serbia branching to Bosnia. The gas was to be used for heating in Sarajevo and supplying the Zvornik alumina plant. Financial problems delays construction.

During 1978, construction continued on the pipeline system which should bring Middle East crude oil to refineries in Yugoslavia, Hungary, and Czechoslovakia, and in 1979 the system was completed. The starting point of the 34-million-ton-per-year crude oil pipeline is on the island of Krk near Omisalj, where a deep-sea port, with berths for two 350,000-deadweight-ton tankers, was operational. Cost of the project reached about $510 million, an increase of about 35% over figures published in 1969.

Uranium.—During both years, 1978 and 1979, construction, by Westinghouse, of the first Yugoslav nuclear powerplant, Krsko (615 megawatts electrical), continued near the town of Krsko in Slovenia. Reportedly the new completion date should be sometime in 1980. Work on development of the Zirovski Vrh mine and the yellow cake plant at Rudnik Urana Zirovski Vrh, at Skofija Loka, Slovenia, also continued.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Yugoslav dinars to U.S. dollars at rate of 18 dinars=US$1.00.

The Mineral Industry of Zaire

By Miller W. Ellis[1]

The mineral industry of Zaire continued to provide 60% of the country's foreign exchange and to maintain its position as the world's leading producer of cobalt and industrial diamond. High transport costs, lack of fuels, and low prices for copper, all contributed to diminished production of Zaire's minerals (except for cobalt) during 1978, but higher copper and cobalt prices the following year improved the economic position of the State-owned La Général des Carriéres et des Mines du Zaire (Gécamines) in the Shaba Region, and contributed to increased production by the entire mineral sector.

Construction of additional production and township capacity at Kolwezi, Gécamines largest and westmost center of operations, was interrupted by armed invaders early in the morning of Saturday, May 13, 1978. The shutdown of mine and plant operations ordered by the invaders proceeded in a sequential manner for the next 6 days. French and Belgian paratroops regained control of the area and, by May 23, the remaining expatriates were evacuated, most to Europe, a few to Lubumbashi. Electricity supply was restored and operations resumed at mining, concentrating, and refining plants by Zairian staff with limited supervision by expatriate staff commuting by air from Lubumbashi. Despite the imposition of a dusk-to-dawn curfew and shortages of automobiles, light trucks, and acid; near-normal ore and metal production had been achieved by about June 14. Resumption of most construction projects was delayed for months, and construction of the Inga-Shaba powerline was not fully restored until October 1979. Short-term European employees of contractors appeared to have borne the brunt of both casualties and looting, and the resultant dearth of skilled and experienced staff extended throughout 1979. Hundreds of European and African casualties resulted from this second armed invasion in little more than a year, and the subsequent exodus of expatriates caused a shortage of skilled and experienced technical staff that was not completely relieved by yearend 1979.

Gécamines P-2 expansion plan was interrupted and its priorities directed at completing the Dikuluwe-Mashamba (DIMA) concentrator. The country's external debt was rescheduled and its finances monitored by officials of the International Monetary Fund (IMF). Zaire's unit of currency the Zaire (Z) was quoted at Z0.82=US$1.00 in January 1978 but was devaluated in May 1978 and again in January and August 1979. It was quoted at Z2.046=US$1.00 in September 1979. The Bank of Zaire (BOZ) has continued to allow Gécamines to retain 45% of its foreign exchange earnings.

PRODUCTION AND TRADE

Production of most of Zaire's mineral commodities declined through 1978 except for Gécamines byproducts cobalt and silver, which showed substantial increases over 1977 levels. World copper price increases in late 1978 and early 1979 enhanced the country's credit and financial status and improved the delivery time of fuel and consumable stores to Gécamines and the mining industry in general and resulted in a generally higher mineral production rate in 1979. Details of mineral production for both years are shown in table 1.

The Société de Développement et Miniére

du Zaire (Sodimiza) continued to ship copper sulfide concentrates through Zambia, Southern Rhodesia, and Botswana, for dispatch to Japan from the South African port of East London. Part of Gécamines copper metal was also shipped from East London, but most of its copper went by rail-river barge-rail Voie Nationale to the sea port of Matadi in the Zaire River mouth. The alternative route by rail to Kalemie on Lake Tanganika, lake steamer to Kigoma, and Tanzania railroad to the congested port of Dar es Salaam was little used as was the Zambian Tazara route, also to Dar es Salaam. Internal strife in Angola restricted international traffic on the Benguela Railroad, and the Rhodesia-Beira railroad remained closed at the Mozambique border. Most of Zaire's cobalt and minerals of high unit value were shipped by airfreight.

Table 1.—Zaire: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^p	1979^e
METALS				
Cadmium, smelter	266	246	186	240
Cobalt:				
Mine output, metal content^e	11,000	10,200	13,300	15,000
Refined	^r10,696	10,215	13,125	14,515
Columbium-tantalum concentrate	79	83	18	22
Copper:				
Mine output, metal content	444,432	481,550	423,800	377,000
Blister and leach cathodes	^r413,000	443,000	390,700	343,800
Refined	66,018	98,708	102,797	98,700
Gold[1] troy ounces	^r91,098	80,418	76,077	75,000
Iron and Steel: Crude steel^e	30,000	30,000	NA	NA
Manganese ore and concentrate	^r182,184	41,019	--	--
Silver thousand troy ounces	2,472	2,730	4,391	2,500
Tin:				
Mine output, metal content	3,776	5,073	4,390	4,500
Smelter, primary	478	765	496	500
Tungsten, mine output, metal content	237	170	148	100
Zinc:				
Mine output, metal content	67,800	73,000	73,700	68,000
Metal, primary, electrolytic	61,677	51,049	43,500	43,000
NONMETALS				
Cement, hydraulic thousand tons	^e655	489	472	450
Diamond:				
Gem^e thousand carats	591	561	562	500
Industrial^e do	11,230	10,652	10,688	10,000
Total do	11,821	11,213	11,250	11,100
Lime	^r ^e110,000	101,155	^e100,000	100,000
Sulfur:				
Byproduct of metallurgy, S content of sulfuric acid produced	37,200	30,700	^e30,000	30,000
Sulfuric acid, gross weight	NA	151,423	NA	NA
MINERAL FUELS AND RELATED MATERIALS				
Coal, bituminous thousand tons	100	128	107	100
Petroleum:				
Crude thousand 42-gallon barrels	9,075	8,255	6,604	7,400
Refinery products:				
Gasoline do	579	275	279	NA
Kerosine and jet fuel do	318	142	231	NA
Distillate fuel oil do	698	320	289	NA
Residual fuel oil do	878	351	529	NA
Liquefied petroleum gas do	12	15	--	NA
Refinery fuel and losses do	245	110	125	NA
Total do	2,730	1,213	1,453	NA

^e Estimate. ^p Preliminary. ^r Revised. NA Not available.

[1] Excludes gold recovered from blister copper.

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Table 2.—Zaire: Exports of copper, by type and destination

(Metric tons)

Type of copper and destination	1976	1977	1978
Copper in ores and concentrates[1]	31,400	41,500	32,500
Blister copper:[2]			
Belgium-Luxembourg	304,404	344,860	282,659
France	10,835	12,010	10,321
Germany, Federal Republic of	--	--	8,060
Italy	250	220	125
Other	--	--	125
Total	315,489	357,090	301,290
Refined copper:			
Belgium-Luxembourg	6,997	5,814	3,819
France	7,600	5,649	4,749
Germany, Federal Republic of	--	1,550	16,150
Italy	28,842	42,848	28,503
Japan	17,488	11,893	12,426
Netherlands	637	7,384	6,060
Romania	4,000	4,000	10,000
Other	8,417	11,505	21,938
Total	73,981	90,643	103,645

[1] Details on destinations not available.
[2] Includes leach cathodes.

Source: World Bureau of Metal Statistics. World Metal Statistics. August 1979, p. 70.

COMMODITY REVIEW

METALS

Copper, Cobalt, Zinc, and Associated Metals (Shaba Region).—Gécamines production of zinc, and cadmium metals declined in 1978 and increased slightly in 1979, but selective mining of high-cobalt ore was reportedly responsible for cobalt output increasing in 1978-79. World prices of copper, tin, and zinc also declined in early 1978 but increased slowly during the latter part of the year. A substantial increase was reported in early 1979 and by mid-year Gécamines and Zaire's financial position was substantially improved.

Gécamines and Zaire's foreign exchange earnings were increased by the enhanced prices for cobalt metal following the invasion of May 1978. The following table lists producer and spot prices per pound of cobalt metal in U.S. dollars.

Dates	Producer price	Spot price
December 21, 1977	$6.40	
February 24, 1978	6.85	
May 24, 1978	8.50	
July 20, 1978	12.50	
September 14, 1978	18.00	
October 27, 1978	20.00	$39.00
November 10, 1978	20.00	49.00
February 1, 1979	25.00	39.00
May 23, 1979	25.00	42.00
July 27, 1979	25.00	30.00
August 24, 1979	25.00	29.00

Gécamines copper metal production dropped nearly 60,000 tons because of the inability to move copper concentrates from Kolwezi to Shituru and to Lubumbashi for more than a month in May and June; and of the lack of sulfuric acid after furnaces at Shituru collapsed while imports from Zambia were temporarily cut off. Exports of Gécamines copper continued by the rail-river barge-rail route to Matadi and by the longer southern route to the port of East London in the Republic of South Africa. Much of the cobalt was packed in drums and shipped by air.

Part of Gécamines shortfall in copper production was balanced by increased amounts of copper in the concentrates exported by way of East London to Japan by Sodimiza. In 1978 the Musoshi concentrator handled a larger proportion of higher grade ore from Sodimiza's Kinsinda mine than of the chalcopyritic ore from the Musoshi mine. The tonnage of ore milled decreased but both the amount and copper content of the concentrate increased during 1978-79. Sodimiza continued to operate at a loss because of transport costs on the long rail route to the port of East London in the Republic of South Africa. Returning rail cars carried coal, coke, maize, and other foodstuffs vital for the Shaba Region's mining industry. Sodimiza's operations were 40 to 100 kilometers southeast of Lubumbashi and Gécamines eastern center of operations and were not directly affected by the May 1978 invasion, but Sodimiza's staff was reduced from 3,769 to 3,071 Africans and from 138 to 94 expatriates, mostly Japanese employees of Nippon Mining Co., in 1978.

The Société Minière de Tenke-Fungurume (SMTF) was reorganized in mid-1979. The U.S. firm Amoco Minerals Co., Standard Oil Co. (Indiana), sold its 28% interest to Bureau de Recherches Géologiques et Minières (BRGM) who became majority owner at 34.4%. Chartered Consolidated Ltd., with 28%, relinquished management of SMTF to the French BRGM, and the manager of Leon Tempelsman and Sons, Inc. of New York became chairman. The SMTF concession had reported reserves of 55 million tons of ore containing 5.7% copper and 0.45% cobalt. Approximately $280 million of an estimated capital cost of $600 million had been spent in developing the property formerly owned by Gécamines, when work was halted because of lack of fuel and supplies following the closure of the Benguela Railroad in August 1975. The cost of care and maintenance since January 1, 1976, was estimated at $400,000 per month. It was reported that new mining equipment and ore trucks were sold locally during 1979.

Gécamines zinc, cadmium, and most of its silver production came from the Kipushi mine and concentrator which produced both copper and zinc sulfide concentrates. The copper sulfide concentrates were smelted at Lubumbashi to produce blister copper ingots and zinc and cadmium-rich flue dusts. Both the zinc concentrates and the flue dusts were shipped to the Metalkat factory on the Musonoi River north of Kolwezi. The zinc sulfide concentrate was roasted and sulfuric acid made from the exhaust fumes while zinc metal ingots were produced from the residues. Both zinc and cadmium were extracted from the flue dusts and silver was recovered from both zinc and copper refinery tank house sludges either in Zaire or in Belgium where much of Gécamines blister copper was refined.

Gold.—Most of Zaire's gold continued to come from mines operated by the State agency, Office des Mines d'Or de Kilo-Moto, near the Ugandan and Sudanese borders in the Haute-Zaire Region of northeastern Zaire. Smaller amounts were byproducts of Gécamines copper industry, recovered by treatment of refinery tankhouse slimes in Belgium, and from alluvial-eluvial operations in many of Sominki's tin and tungsten mines. The following table shows the declared sources of Zaire's gold output since 1974 in troy ounces.

	1974	1975	1976	1977	1978	1979[e]
Kilo-Moto	11,724	79,830	66,809	59,479	58,032	55,700
Sominki	17,426	17,201	19,548	16,525	14,114	15,000
Gécamines	4,662	4,983	4,180	3,601	3,633	4,000
Miscellaneous	979	976	556	813	298	300
Totals	134,791	102,990	91,093	80,418	76,077	75,000

[e] Estimate.

Kilo-Moto reported reserves containing approximately 40,000 and 360,000 troy ounces of recoverable gold in vein deposits near Kilo and Moto, respectively. The company was also exploring the D7 Kanga orebody with a potential of 1.28 million troy ounces of gold near Kilo, and a sulfide orebody with a potential of an additional 210,000 troy ounces of gold in the Moto area. Sominki estimated reserves of 640,000 troy ounces at its newly discovered Twangiza deposit in Kivu Region. Since 1976 when the Government outlawed mining of alluvial gold, illicit placer mining has continued in both Haute-Zaire and Kivu Regions. Much of this contraband gold is reportedly marketed in Goma and Bakuvu or smuggled to Bujumbura in Burundi or to Uganda or Sudan.

Manganese.—There has been no production of manganese ore reported by Société Minière de Kisenge (SMK) since the invasion of March 1977 and occupation of the company headquarters at Kisenge, about 200 kilometers west of Kolwezi. The only mineral cargo carried on the abortive Benguela Railroad reopening trip in April 1979 was reportedly manganese ore from SMK's 500,000 ton stockpile. Meanwhile, Japanese, West German, and Spanish firms have examined SMK's installation, and have considered various proposals for upgrading the ore, producing manganese metal, or manufacturing dry cell batteries. SMK reported

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that 54 railway carloads of ore had arrived in Lobito Bay during November and December 1979.

Tin, Tungsten, and Byproduct Columbium-Tantalum.—The northeastern part of Shaba Region and east-central part of Kivu Region were the sources for Zaire's output of several resistant minerals recoverable by relatively simple methods of gravity concentration. The 50% State-owned Société Zairetain managed by the Belgian company Geomines was one of two major producers of these commodities. Zairetain produced refined tin, columbite-tantalite, and tantaliferous slag or scoria at its smelter near Manono. Severe floods on the Lualaba River in March of 1979 cut both rail and road traffic between Manono and Lubumbashi preventing the delivery of heavy equipment, food, fuel, and other supplies to Zairetain, and export of its minerals for nearly 6 months. A study of the feasibility of mining the hard unweathered pegmatite of the Manono deposit and extracting tin and lithium minerals therefrom was to be completed in 1980.

The Société Minière et Industrielle de Kivu (SOMINKI) was the largest mining company in the Kivu Region, with a staff of nearly 18,000, including about 100 expatriates. The 28% State-owned company operated a number of mines in the central and eastern parts of the Kivu Region producing tin ore (cassiterite), tungsten ore (wolframite), columbite-tantalite, gold, and monazite. Diminished production during 1978-79 was chiefly due to shortages of motor fuel and spare parts aggravated by the isolated position of many of the deposits. SOMINKI was exploring a deposit of pyrochlore (a columbium-thorium-rare-earth mineral). The Krupp Co. reported encouraging results from preliminary pilot plant tests in the Federal Republic of Germany. They proposed spending $2 million for testing at another pilot plant to be built in Zaire, and constructing a full scale plant by about 1984 if the results so warrant.

NONMETALS

Cement.—The Belgian firm, Société d'Etudes et de Gestion de Cimenteries (EGECIM), was the parent of three of Zaire's cement companies. Gécamines agreed to purchase 40% of EGECIM's Cimenteries du Shaba (CIMSHABA) in 1976, and in 1978 completed payment from its foreign exchange earnings. CIMSHABA produced 42,670 tons of portland cement, 20,478 tons of rough cast cement, and a little lime in 1978, most of which was sold to Gécamines with lesser amounts to Sodimiza and to Constructeur Inga-Shaba (CIS), the local subsidiary of the American Morrison-Knudsen Co. At the beginning of 1979 CIMSHABA's cement was sold at the Government-controlled price of Z3.50 per 50-kilogram bag, but a subsequent devaluation of the local currency made this the equivalent of $2.28, far below cost. Another Gécamines subsidiary, Calcaire, Chaux, Ciments of Kakontwe, near Likasi, produced 387,904 tons of limestone, 7,224 tons of metallurgical cement, and 94,669 tons of lime, all sold to Gécamines. A third oven to increase lime production was finished in 1979. Ciments-Laçs, another subsidiary of EGECIM, operated a small cement plant near Kalemie on Lake Tanganyika at reduced capacity in 1978 and ceased operations because of flooding in early 1979.

EGECIM owned 51% of Zaire's largest cement manufacturer, Société des Ciments du Zaire (CIZA). The Zairian Government owned 15%, two Zaireian development banks held 12.5%, and private interests 21.5%. CIZA's plant at Lukala had a capacity of 630,000 tons, but produced only 231,381 tons of cement in 1978 and less than that in 1979. Most of the production was consumed in or near Kinshasa, but 22,000 tons were exported to the Congo (Brazzaville) and the Central African Republic. The Cimenterie Nationale's (CINAT) 300,000-ton-capacity plant near Kimpese sold most of the 163,517 tons of cement produced in 1978 to customers in the Kinshasa vicinity.

Diamond.—The Zairian-owned Société Minière de Bakwanga (MIBA) continued to be the largest producer of low-grade industrial diamond in the world, accounting for approximately 30% of world production in 1978. Operations at the Mbuji Mayi pits were handling increasing amounts of hard unweathered kimberlite with attendent higher recovery costs. Even at the low price of $3 to $4 per carat for Zairian industrials, diamonds continued to be the country's fourth largest earner of foreign exchange after copper, cobalt, and coffee. The value of 1978-79 production was about $150 million, and it was estimated that illicit mining and smuggling involved 30% to 50% of the declared Zairian production. Most of the smuggled diamonds were sold through Bujumbura in Burundi, and Brazzaville in the Republic of the Congo. Total production for 1979 was estimated at 14.2 million carats worth $250 million including smuggled diamonds.

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In May 1978 the Zairian Government (GOZ) returned 20% of MIBA's equity to its former owners, the Société Généràl de Belgigue and the Oppenheimer group, and allowed the company access to 20% of its foreign exchange earnings. In return, a purchasing service for spare parts and supplies was reactivated with a loan to MIBA worth $2.45 million in hard currency at 6% interest with a 5-year grace period. The GOZ also agreed to partially finance MIBA's security, school, and hospital services and freeze diamond export tax at 12.5% of gross receipts for 4 years.

MINERAL FUELS

Coal.—The Societe des Charbonnages de la Luena, north of Kolwezi, and the Makala coal mine near Kalemie on Lake Tanganyika were Zaire's only domestic sources of low-grade coal. Production from Makala was used for the production of cement at the nearby Ciment-Laçs plant, and that from Luena was extracted by Gécamines for use in its metallurgical and cement plants. Coal and coke were imported from South Africa, Southern Rhodesia, and possibly from Zambia.

Petroleum.—Production of crude petroleum from Zaire's offshore fields decreased slightly in 1978 and increased again in 1979. A desalinization plant to process Zaire's heavy, salty, crude and to blend it with high-grade imported crude to make a suitable feedstock for Zaire's Moanda refinery was completed.

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[1] Physical scientist, Branch of Foreign Data.

The Mineral Industry of Zambia

By Miller W. Ellis[1]

The mineral industry of the Republic of Zambia continued to provide some 90% of the country's foreign exchange credit, and Zambia maintained its position as the world's fifth largest copper producer through 1978 and 1979. With the increased production from a new cobalt facility at Chambishi in 1979 it became the world's second largest cobalt producer, after neighboring Zaire. Transport delays through the Tanzanian port of Dar es Salaam continued to be an expensive item in the cost of producing and delivering copper metal, but were substantially offset by the increased world price of copper during 1978 and 1979.

Zambia's 1978 copper exports were valued at $760.3[2] million and accounted for 27% of the gross domestic product (GDP) estimated at $2,819.5 million, up 10% from the GDP for 1977. Both major copper producing companies reported a return to profitable operation during the latter half of 1978, and Roan Consolidated Mines Ltd. (RCM) declared a dividend for the first time in 5 years for the fiscal year ended June 30, 1979. The overall profit by both companies through 1979 was estimated at more than $600 million, but the tax benefit to the Government of the Republic of Zambia (GRZ) was negligible because the tax system allowed losses to be carried forward from bad years and applied against profits in good years.

In mid-1979 RCM followed the precedent set by Nchanga Consolidated Copper Mines Ltd. (NCCM) in 1978 and agreed to convert at least $50 million of indebtedness to the GRZ into 7.4 million RCM shares to be held by the Government owner-agency Zambia Industrial and Mining Corp. Ltd.(ZIMCO). This effectively diminished the minority share holding (mostly AMAX Inc.) from 49% to 40% and increased GRZ's share from 51% to 60%.

Zambia's use of Kenya's Mombasa port was halted when Tanzania closed its Kenya border in February 1977. Subsequently Zambia depended almost entirely on Tanzania's increasingly congested port of Dar es Salaam for both imports and mineral exports. The lack of vehicle capacity and other deficiencies on both the Tanzania Zambia Railway (Tazara) and the older TanZam Road Service contributed to a transport fiasco involving large tonnages of imported commodities awaiting handling at the port and at their destination, and a total of 100,000 tons of copper metal stranded at the port, along the transport route, or stockpiled at the mines. Payment for most of Zambia's copper could be made as soon as it was certified as loaded aboard ship, so that efficient handling and smooth transit would have allowed both Zambia and Tanzania larger and faster profits. Some of the delay was due to natural causes such as track washouts causing derailments in both Tanzania and Zambia, but there was some question as to whether inadequate maintenance of equipment and roadbed had contributed to these accidents.

Early in October 1978 the Zambian President announced the reopening of the southern route through Southern Rhodesia (Zimbabwe) to South African ports in order to expedite the arrival of food and fertilizer in Zambia, and speed the sale of its copper. South Africa also loaned Zambia four locomotives to assist in the distribution of fertilizer. Heavy rains in April and May of 1979 washed out some 100 kilometers of track in Tanzania. Road traffic through Botswana to South Africa was halted when the pontoon across the Zambezi River at

Kazungula was damaged in April 1979. Repeated attempts to export copper and import fertilizer by way of Mozambique's ports of Nacala and Beira met with scant success. These routes reportedly handled 7,200 tons each during the dry month of July, but the road hauls from Lusaka to Salima railhead in Malawi for Nacala port, and to Moatize coal mine and railhead in Mozambique for Beira port, could not maintain this rate for an extended period. During most of the year 10,000 tons per month was handled by TanZam Road Services trucks to Dar es Salaam, 20,000 tons per month was hauled by Tazara, and a similar quantity went by the southern rail route to South African ports. Traffic over the southern route increased by 50% in October 1979 when the multispan bridge over the Chambishi River in northeastern Zambia was destroyed. TanZam trucks travelling an alternate route continued hauling copper to Dar es Salaam where a backlog of 32,000 tons of copper helped maintain copper export shipments through the yearend.

PRODUCTION AND TRADE

Production of copper in Zambia increased slightly in 1978 but decreased during 1979. The London Metal Exchange (LME) price per ton of copper rose from $1,467 in December 1978 to $2,010 in March 1979 and thereafter fluctuated between $1,620 and $2,050 until the yearend. Prices of other mineral commodities also rose during the 2 year period, but none so much as cobalt, which was in short supply and subject to a 70% quota on sales even before the May 13, 1978, invasion of Zaire's Kolwezi metallurgical center. Panic buying and a short-lived "gray market" pushed cobalt spot prices to more than twice the producer price. The following tabulation compares, in U.S. dollars per pound, the producer price changes agreed on between Zambian and Zairian officials and the prevailing spot prices for this period.

Date	Producer price	Spot price
Dec. 21, 1977	$6.40	NA
Feb. 24, 1978	6.65	NA
May 24, 1978	8.50	NA
July 20, 1978	12.50	NA
Sept. 14, 1978	18.00	$35.00
Oct. 27, 1978	20.00	39.00
Nov. 10, 1978	20.00	49.00
Feb. 1, 1979	25.00	39.00
June 8, 1979	25.00	42.00
July 27, 1979	25.00	30.00
Oct. 5, 1979	25.00	24.00
Nov. 9, 1979	25.00	21.00
Dec. 28, 1979	25.00	22.00

NA Not available.

Despite the more favorable prices in 1979 Zambia's mineral production slumped except for cobalt. The continuing and ubiquitous shortages of spare parts, supplies, and skilled staff to effect repairs promptly and carry out preventive maintenance on schedule produced epidemics of partial and temporary shutdowns. As a result, fewer tons of lower grade ore were mined from which reduced amounts of substandard concentrates were milled, and less metal was smelted thoughout the mining industry. Production of zinc by the Broken Hill Division of NCCM was up slightly in 1978, while lead production declined. Prices of both metals reached near record levels in the first half of 1979. Zambia's reported mineral production for 1978 and estimated production for 1979 appear in table 1.

The dollar value of Zambia's 1974-78 trade is shown in the following tabulation:

	1974	1975	1976	1977	1978
Total exports(A)	1,406.6	809.8	1,054.0	898.1	818.4
Copper exports(B)	1,308.1	783.5	965.4	818.7	760.3
Total imports(C)	985.0	1,137.7	800.5	828.5	745.1
A-C balance	+421.6	-327.5	+253.5	+69.6	+73.3

Source: International Financial Statistics. v. 33, No. 3, March 1980, p. 426.

The balances do not indicate an accumulation of foreign exchange because of repayments, servicing of loans, and other disbursements.

Zambia's mineral exports are shown in table 2, copper exports and destinations in table 3, and imports of mineral-related commodities in table 4.

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Table 1.—Zambia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
METALS				
Cadmium metal	7	4	[e]4	4
Cobalt:				
Mine output, metal content of concentrate	3,262	3,677	3,100	5,100
Metal	2,175	1,704	1,733	3,175
Copper:				
Mine output:				
Total content of ore	849,642	819,176	753,000	720,000
Recoverable content of concentrate	708,867	656,000	642,972	600,000
Metal:				
Blister and anodes, Cu content[1]	705,906	650,512	657,119	595,104
Refined	[r]694,157	648,043	627,744	600,000
Gold[2] troy ounces	10,955	[r][e]11,250	8,457	7,941
Iron ore: Magnetite	[e]100	[e]100	41	50
Lead:				
Mine output, content of ore	15,549	13,542	13,000	13,000
Metal, smelter (refined)	13,583	13,109	10,701	11,000
Selenium, elemental kilograms	--	15,974	30,881	31,700
Silver[3] thousand troy ounces	1,065	[e]1,450	1,069	1,000
Tin concentrate, gross weight	([4])	3	([4])	1
Zinc:				
Mine output, content of ore	48,777	45,018	45,000	45,000
Metal, smelter plus electrolytic	36,327	40,114	41,600	40,000
NONMETALS				
Cement, hydraulic thousand tons	385	[e]400	123	200
Clays, building, not further specified cubic meters	NA	NA	NA	[5]24,190
Feldspar	1,027	832	334	500
Fluorspar	3	[e]10	76	80
Gem stones:				
Amethyst kilograms	25,878	10,252	9,487	[5]4,860
Emerald do	18	91	429	400
Gypsum	4,650	4,634	1,726	2,000
Lime, hydraulic, and quicklime thousand tons	144	[e]250	[e]250	250
Nitrogen, N content of ammonia[e]	20,000	20,000	20,000	20,000
Sand, construction cubic meters	NA	NA	NA	[5]194,955
Stone:				
Limestone thousand tons	565	[e]600	227	[5]416
Phyllite do	6	13	10	[5]7
Stone, miscellaneous, for building cubic meters	NA	NA	NA	[5]216,136
Sulfur, elemental basis (produced as sulfuric acid):				
From pyrite	8,773	8,385	[e]6,000	6,000
From copper ores	[r][e]89,236	[e]86,915	108,784	110,000
From lead-zinc ores	1,991	--	--	--
Total	[r][e]100,000	[e]95,300	115,000	116,000
Talc	106	[e]100	[e]100	--
MINERAL FUELS AND RELATED MATERIALS				
Coal, bituminous thousand tons	773	708	1,169	[5]590
Petroleum refinery products:[e]				
Gasoline thousand 42-gallon barrels	1,530	1,597	1,658	NA
Jet fuel do	320	294	360	NA
Kerosine do	155	167	200	NA
Distillate fuel oil do	2,611	2,551	2,686	NA
Residual fuel oil do	1,332	1,233	1,399	NA
Other do	134	110	152	NA
Refinery fuel and losses do	374	383	194	NA
Total do	6,456	6,335	6,649	6,600

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] Includes leach cathodes.

[2] Primarily contained in blister copper and refinery muds.

[3] Refined silver and silver contained in blister copper and refinery muds.

[4] Less than 1/2 unit.

[5] Reported figure.

Table 2.—Zambia: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	Principal destinations, 1976
METALS		
Aluminum metal including alloys, unwrought and semimanufactures	4	Zaire 3.
Cobalt	2,312	United States 994; Japan 545; United Kingdom 544.
Copper metal including alloys:[1]		
Scrap	4	All to Kenya.
Unwrought	744,197	United States 126,782; West Germany 110,643; United Kingdom 101,716.
Semimanufactures	356	Kenya 350.
Iron and steel semimanufactures:		
Bars, rods, angles, shapes, sections	10	All to Zaire.
Universals, plates, sheets	83	Zaire 82.
Wire	3	Tanzania 2; Mozambique 1.
Tubes, pipes, fittings	28	Zaire 17; Kenya 10.
Lead metal including alloys, all forms	14,767	Italy 7,176; Republic of South Africa 4,931; India 1,002.
NONMETALS		
Cement	2,384	Zaire 2,381.
Fertilizer materials: Ammonia	14	All to Zaire.
Gypsum and plasters	16	All to Malawi.
Salt	46	All to Zaire.
Stone, sand and gravel	11,682	Do.
Sulfur:		
Elemental	3,242	Do.
Sulfuric acid	8,829	Zaire 8,803.
Talc	29	All to United Kingdom.
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	14	All to Zaire.
Kerosine do.	(2)	Do.
Jet fuel do.	19	Do.
Distillate fuel do.	31	Do.
Mineral jelly and wax do.	393	All to United States.
Liquefied petroleum gas do.	2,383	Malawi 2,303; Zaire 80.

[1] Copper data for 1976-78 are given in greater detail in table 3; 1976 data differ from those reported in this table owing to a difference in source.

[2] Less than 1/2 unit.

Table 3.—Zambia: Exports of copper, by type and destination

(Metric tons)

Type of copper and destination	1976	1977	1978
Blister:			
United Kingdom	1,887	--	--
United States	1,006	--	7,571
Yugoslavia	15,698	5,549	12,427
Other	2,514	2,579	5,606
Total	21,105	8,128	25,604
Refined:			
Belgium-Luxembourg	17,778	21,122	10,077
China	20,000	23,493	17,508
France	50,061	66,432	61,234
Germany, Federal Republic of	106,857	90,777	50,734
India	39,538	13,425	34,896
Italy	73,314	72,920	51,672
Japan	124,316	128,231	133,252
Sweden	16,847	19,556	18,766
Switzerland	14,350	9,167	2,580
United Kingdom	96,335	101,621	[illegible]
United States	125,773	76,475	58,771
Yugoslavia	183	4,000	17,882
Other	26,994	19,867	17,868
Total	712,346	647,086	540,897

Source: World Bureau of Metal Statistics. World Metal Statistics. August 1979, p. 71.

Table 4.—Zambia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	Principal sources, 1976
METALS		
Aluminum metal including alloys, all forms	645	United Kingdom 204; Tanzania 201; Israel 115.
Antimony ore and concentrate	8	All from Belgium-Luxembourg.
Arsenic trioxide and acid	33	France 18; West Germany 10.
Chromium oxide and hydroxide	10	All from United Kingdom.
Cobalt metal including alloys, all forms	12	All from Zaire.
Copper metal including alloys:		
Scrap	6	All from Republic of South Africa.
Unwrought	10	Italy 7.
Semimanufactures	407	United Kingdom 221; Zaire 77; Republic of South Africa 39.
Iron and steel:		
Ore and concentrate	1	All from United Kingdom.
Metal:		
Pig iron, including cast iron	171	West Germany 117; Republic of South Africa 54.
Sponge iron, powder, shot	14	United Kingdom 13.
Ferroalloys	604	Japan 561.
Steel, primary forms	199	All from Japan.
Semimanufactures:		
Bars, rods, angles, shapes, sections	16,660	Republic of South Africa 5,317; Japan 4,700; United Kingdom 3,167.
Universal, plates, sheets	19,232	Japan 15,766; United Kingdom 700.
Hoop and strip	4,369	Japan 3,700.
Rails and accessories	4,513	Republic of South Africa 2,792; United Kingdom 942.
Wire	3,090	Japan 706; Belgium-Luxembourg 491; Malawi 466; West Germany 427.
Tubes, pipes, fittings	5,277	Japan 1,473; United Kingdom 893; Sweden 886.
Castings and forgings, rough	83	India 76; United Kingdom 6.
Total	53,224	
Lead metal including alloys, all forms	23	United Kingdom 22.
Manganese metal including alloys, all forms	129	All from Republic of South Africa.
Nickel metal including alloys, all forms	5	United Kingdom 3.
Platinum-group metals and silver:		
Platinum-group troy ounces	599	United Kingdom 476.
Silver do.	1,806	United Kingdom 1,147.
Tin metal including alloys, all forms	58	Singapore 47; United Kingdom 11.
Titanium metal including alloys, all forms	471	United Kingdom 243; France 139.
Zinc:		
Oxide	452	United Kingdom 385.
Metal including alloys, all forms	20	All from United States.
Other metals including alloys, all forms:		
Alkali, alkaline-earth, rare-earth metals	7	Israel 4; Republic of South Africa 2.
Base metals	67	China, mainland, 30; Italy 18; United Kingdom 17.
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum	5	China, mainland, 3; United Kingdom 2.
Grinding and polishing wheels and stones	59	United Kingdom 45.
Asbestos	3,788	Swaziland 2,725; Switzerland 600; Canada 379.
Cement	606	United Kingdom 576.
Chalk	187	Kenya 97; United Kingdom 90.
Clays and clay products (including all refractory brick):		
Crude:		
Kaolin (china clay)	102	United Kingdom 100.
Fire clay	19	All from Republic of South Africa.
Fuller's earth	69	Japan 31; United Kingdom 20; Republic of South Africa 18.
Other	634	United States 371; United Kingdom 226.
Products:		
Refractory (including nonclay brick)	1,463	United Kingdom 952; Republic of South Africa 324.
Nonrefractory	15,640	United Kingdom 7,131; Italy 6,239.
Diamond thousand carats	80,300	All from United Kingdom.
Feldspar and fluorspar	36	United Kingdom 20; United States 16.
Fertilizer materials:		
Manufactured:		
Nitrogenous	116,265	Republic of South Africa 70,452; Italy 44,991; Poland 822.
Phosphatic	3,884	All from Republic of South Africa.
Potassic	7	All from United Kingdom.
Other, including mixed	1	Do.
Ammonia	2	Italy 1.
Gypsum and plasters	43	All from United Kingdom.
Mica	4	United States 3; India 1.

Table 4.—Zambia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	Principal sources, 1976
NONMETALS —Continued		
Precious and semiprecious stones, except diamond kilograms	20	All from United Kingdom.
Salt	67,047	United Kingdom 57,119.
Sodium and potassium compounds, n.e.s.:		
Caustic soda	3,216	West Germany 1,250; United Kingdom 543; Netherlands 504.
Caustic potash and sodic and potassic peroxides	7	All from West Germany.
Stone, sand and gravel:		
Gravel and crushed rock	1	All from Republic of South Africa.
Quartz and quartzite	2	All from United Kingdom.
Sand, excluding metal bearing	63	Do.
Sulfur:		
Elemental:		
Other than colloidal	83	Do.
Colloidal	18	United Kingdom 8; West Germany 5; Sweden 5.
Sulfuric acid	59	United Kingdom 35; West Germany 20.
Talc, steatite, soapstone, pyrophyllite	35	India 25; United Kingdom 10.
Other:		
Oxides and hydroxides of magnesium, strontium, barium	2	All from United Kingdom.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	84	United Kingdom 83.
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	281	United Kingdom 249.
Carbon black	1,072	United Kingdom 519; Republic of South Africa 218; India 212.
Coke and semicoke	37,594	All from West Germany.
Petroleum:		
Crude thousand 42-gallon barrels	6,854	All from Saudi Arabia.
Refinery products:		
Gasoline do	28	All from Iran.
Jet fuel do	(1)	All from Kenya.
White spirit do	6	Iran 5.
Lubricants do	3,038	United Kingdom 810; Republic of South Africa 707; Kenya 555.
Mineral jelly and wax do	18,766	West Germany 7,085; United States 4,161; Singapore 2,264.
Other:		
Nonlubricating oils, n.e.s do	58	United Kingdom 57.
Pitch and pitch coke do	309	United States 200; United Kingdom 109.
Bitumen and bituminous mixtures, n.e.s do	2,284	United Kingdom 633; Kenya 587; Netherlands 509.
Liquefied petroleum gas do	37	All from Netherlands.
Total do	24,526	

[1] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Copper and Byproduct Cobalt.—Zambia's two major mining companies milled nearly 31 million tons of ore containing almost 753,000 tons of copper. Nearly 7 million tons of ore contained 122,171 tons of copper and 8,691 tons of cobalt. Production of copper improved marginally in 1978 but declined sharply in 1979 as did most other metals except cobalt. RCM treated over 14.5 million tons of ore with copper and cobalt contents of 304,812 tons and 3,336 tons respectively. Details of ore milled during calendar 1978 and of RCM ore reserves as published in RCM's annual report for the year ended June 30, 1979 are shown in table 5.

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Table 5.—Zambia: RCM copper production and ore reserves

Mine	Ore mined and treated			Ore reserves		
	Gross weight (thousand metric tons)	Copper (percent)	Copper content (metric tons)	Gross weight (thousand metric tons)	Copper (percent)	Cobalt (percent)
Mufulira UG	6,268	2.32	145,418	117,000	3.11	--
Luanshya UG	4,003	1.37	54,841	58,000	2.50	--
Baluba UG	1,645	2.00	32,900	70,000	2.39	0.16
Chambishi UG[1]	2,010	2.49	50,049	35,000	2.85	--
Chibuluma UG	457	3.13	14,304	6,800	4.68	.18
Kalengwa OP[1]	154	4.74	7,300	Nil	--	--
Totals and averages	14,537	2.097	304,812	286,800	2,816	.043

OP Open pit. UG Underground.

[1] Mining in both the Kalengwa and Chambishi open pits was halted in the rainy season of late 1978. Stockpiled ore was used to supplement underground ore feeding at Chambishi and as total feed at Kalengwa.

RCM production of finished copper decreased as concentrate stocks were depleted, and as the demand for cathode copper supplanted that for wirebar, some reverberatory furnaces became available for toll smelting. Wirebar production ceased in January 1979, and by June all RCM's smelting requirements were being met by the Mufulira electric furnace and Luanshya's No. 1 reverberatory furnace. One tankhouse line at the Ndola Copper Refinery was shut down in March 1979 and the other was used for toll refining of NCCM copper, while all RCM'S cathode copper was produced at the Mufulira refinery. A 1,000-ton dry concentrate storage bin and two electrostatic precipitators were installed at the Mufulira electric furnace to recover cupriferous dust from the exhaust gases. The Government Mining Engineer and the Chief Inspector of Mines granted permission for lower cost caving methods to be resumed in certain parts of the Mufulira mine, and large-diameter blast hole stoping was also introduced in some areas. The installation of 8.5-cubic-meter Fagergren flotation cells in place of smaller units improved operating results at both Mufulira and Luanshya. An evaporative cooling system was installed to replace the waste heat boilers at Luanshya's No. 1 reverberatory furnace in April 1979. Extensions to Luanshya's Buluba concentrator increased its ore handling capacity to cope with increased ore production, as more of Baluba's underground development was completed.

Equipping of the 1,000-meter Chibuluma West shaft was completed, and the winders and headframe were erected by yearend 1979. Underground development of the Chambishi orebody was completed to the 800-meter level of its 1,000-meter shaft in order to replace the shortfall in ore production caused by the shutdown of open pit mining in late 1978. Mining at the Kalengwa open pit was also halted late in 1978, but the small Kalengwa concentrator continued to treat ore stockpiled during previous years. Extensions to the relatively new roast-leach-electrowin plant at the Chambishi mine were completed early in 1979 and provided facilities for the production of 2,400 tons of degassed electrolytic cobalt metal per year as well as 21,000 tons of leach cathode copper. Feedstock consisted of about 80,000 tons of high-cobalt concentrate from the Chibuluma concentrator, containing 7.15% copper and 2.28% cobalt, and nearly 40,000 tons of similar concentrate from the Baluba concentrator containing 6.88% copper and 3.90% cobalt.

During the 1978 calendar year, NCCM's ore included nearly 4.9 million tons of Rokana ore containing almost 75,000 tons of copper and 5,355 tons of cobalt. Table 6 shows details of production for 1978 and ore reserves as published in the annual report for the year ended March 31, 1979. The Rokana cobalt plant ceased to produce metal from RCM's cobalt hydroxide in January 1979 when Chambishi's new cobalt plant was commissioned. Substantial quantities of gypsum resulting from the use of lime to neutralize spent acid was discarded, but 500 to 1,000 tons per month was sold and railed to Chilanga Cement Ltd. and nearly 1,500 tons per month was used as flux for smelting the high-grade, high-sulfur concentrates produced in early 1978. This practice was halted when the concentrate grade decreased in 1979. Development work was continued in connection with shaft deepening at the Mindola, the Central, and the South Orebody sections of the Nkana mine, with the objective of increased production of cobaltiferous ore in 1980.

Table 6.—Zambia: NCCM copper production and ore reserves

Mine	Ore mined and treated			Ore reserves		
	Gross weight (thousand metric tons)	Copper (percent)	Copper content (metric tons)	Gross weight (thousand metric tons)	Copper (percent)	Cobalt (percent)
Nkana UG	4,868	1.54	74,967	121,320	2.35	0.11
Bwana Mkubwa OP	732	3.05	22,326	1,302	3.77	--
Chingola UG-OP	9,010	3.34	300,934	278,362	3.13	--
Konkola UG	1,660	2.99	49,634	139,548	3.68	--
Kansanshi OP	--	--	--	17,303	2.59	--
Totals and averages	16,270	2.753	447,861	607,853	3.132	.02

OP Open pit. UG Underground.

In July 1978, the presence of cobaltiferous ores near Nchanga was disclosed, and plans for mining them were later announced by NCCM's Managing Director. The evaluation of cobalt mineralization was accelerated in the Nchanga Mining Area, and the following blocks were sampled by diamond drilling for metallurgical testing and mining:

Mine location	Quantity thousand metric tons	Cobalt (percent)	Cobalt (metric tons)
Open pit: Upper orebody	20,800	0.44	91,520
Open pit: Intermediate orebody	3,000	.38	11,400
Underground: Lower orebody (1,820-1,970 feet)	2,100	.40	8,400
Underground: Upper orebody, (1,750-2,270 feet)	3,400	.54	18,360
Totals and averages	29,300	.44	129,680

The copper grades of the cobaltiferous areas sampled in the open pit were not disclosed, but for the underground mine they were 3.70% and 2.13% respectively for lower and upper orebody blocks. Sulfide ores from Nchanga underground mine were to be treated in a section of the Konkola mill, and the high-cobalt concentrate was to be sent to the Rokana cobalt plant, which was to be enlarged and modified for expanded future production. The Nchanga open pit also supplied oxidized ore in the latter part of 1979, but mining was expected to progress into sulfide ores in the pit by 1983. A section of the Chingola concentrator was to be modified, and a new 2,000-ton-per-year roast-leach-electrowin plant was to be completed at Rokana. NCCM negotiated a loan of nearly $30 million from its British customers against cobalt supply contracts for the next 3 years.

Operations at Mimbula I and Chingola C open pits were scheduled to halt in 1978, but additional good-grade ore was found and mined during the rainy season late in 1978 when a slide had stopped the mining of richer ore in the western end of the Nchanga open pit. Higher grade ore from the Fitula pit also compensated for the shortfall of Nchanga ore. The massive new Muntimpa tailings disposal system over basement rocks footwall to the ore horizon was commissioned early in 1978, but in October inspection revealed failure of the natural rubber lining the 24-inch tailings pipelines. The damage was blamed on organic compounds in the tailings, and extensive sections of the line were replaced with pipe containing a nitrile rubber lining. Deliveries of both acid and lime were behind schedule, and a shortage of lubricants forced the shutdown of earthmoving equipment at the Nchanga open pit. Overburden stripping fell behind target and was blamed for the lower grade of ore delivered to the mills. The tailings leach plant was intermittently shut down for lack of lime.

A 57,000-cubic-meter-per-hour air compressor was ordered for installation in an extension to the main Nchanga compressor building. At the Konkola mine, pilot development for the 1,940-meter-level pump chamber was completed and the quantity of water pumped from the mine decreased from 403,000 to 391,000 cubic meters per day. The presence of cobalt in Konkola ore was announced in April 1979.

NCCM's Nampundwe mine southwest of Lusaka was shut down much of 1979 because of civil disturbances. Underground development work during 1978 yielded some 16,000 tons of diluted ore, and the mill produced 2,515 tons of concentrate containing 3.6% copper and 39.4% sulfur, or 991 tons of sulfur equivalent. Virtually none of the concentrate was charged into the Rokana smelter for acid production, and at yearend some 21,000 tons of concentrate remained in stockpiles at the mine, at railhead, and at Rokana.

In January 1979 the Managing Director of Geomines, the Romanian company, joint

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owners with the GRZ of the Mokambo copper mine, announced the possible reopening of the mine depending on the favorable results of an economic feasibility study to be completed during the year. The Mokambo deposit, about 12 kilometers northeast of Mufulira mine, was discovered and drilled on behalf of Mufulira but was relinquished in the early 1970's. The Romanian company took over the property and, after additional drilling, put down a shaft and developed the property to the point of production. It was flooded by torrential rains in 1976 and was not reopened since because of the unfavorable state of the copper market.

Lead, Zinc, and Byproduct Cadmium.—NCCM's Broken Hill Division reported mining 256,000 tons of ore during 1978 including the concentrator feed of 192,000 tons containing 8.53% and 27.04% of lead and zinc respectively, or 16,378 tons of contained lead and 51,917 tons of contained zinc. Selective flotation produced 15,367 tons of lead concentrate with 49.3% lead and 12.3% zinc, and 40,976 tons of zinc concentrate containing 1.1% lead and 56.8% zinc. Mechanical and process control failures and erratic coke supplies limited the operation of the Waelz Kilns, the sinter furnace, and the Imperial Smelting Furnace.

Exploration for additional ore continued in the vicinity of the known orebodies and some ferruginous mineralization containing 3.06% lead and 14.98% zinc over a drilled length of 51.3 meters was found at a depth of 50 meters north of the No. 1 orebed. The recalculation of December 31, 1978, indicated reserves of 2.143 million tons of ore containing 11.0% lead and 23.0% zinc.

Other.—Italy's Government-controlled energy company Agip SpA, which has explored known and prospected for new uranium prospects in Zambia for the past 8 years, announced that it expected to establish by 1980 whether any of its uranium deposits are economically workable. It was reported to be sinking exploratory shafts at prospects in the North Western Province during 1979.

NONMETALS

Cement.—Chilanga Cement continued to produce cement from three coal-fired rotary kilns south of Lusaka. A minor but significant proportion of the production was exported by truck to Mpulungu at the south end of Lake Tanganyika and by lake steamer to Bujumbura in Burundi, and to destinations in Tanzania.

Fertilizer Materials.—Since February 1971 Nitrogen Chemicals Co. Ltd. has produced ammonium nitrate for both fertilizer and explosives from a 68,000- ton-per-year (23,800 tons of nitrogen equivalent per year) plant upstream from the Kafue River damsite.

Gem Stones (Amethyst and Emerald).—The production of amethyst from mines located near the foot of the Zambezi scarp northwest of Lake Kariba has continued to decline. Rough amethyst continued to be upgraded for export by wet cobbing at the Lusaka factory where faceted stones and jewelry were also prepared for domestic sale.

Emerald mining was resumed in early 1978 by the Government Mining Development Corporation (Mindeco) which, [illegible] 70% shareholder in a new partnership, agreed to mine and deliver supplies of rough emerald to Jardine Matheson, which was to cut and polish the emeralds and train Zambian lapidaries in its Hong Kong headquarters for a 15% interest. Consultancy services in both security and mining were to be provided by Anglo American Corporation as the other 15% shareholder. Marketing of both the rough and cut stones was to be handled by the Zambian Metal Marketing Company (MEMACO). Zambia's emerald deposits, south of Kalulushi and northwest of Luanshya, have long been the target for illicit mining and smuggling operations.

MINERAL FUELS

In July 1979 the GRZ announced price increases for oil products except diesel fuel. The equivalent price for regular gasoline became $3.07 per gallon, and premium gasoline increased to $3.36 per gallon as a result of recent OPEC prices hikes.

Production of bituminous coal from the Maamba colliery reached more than 1 million tons during 1978, but the lack of spare parts, faulty ropeware, and problems with the washing plant became chronic drags on throughput during 1979. The company received a $6 million loan from the African Development Bank for expansion and improvements in 1979 but found difficulty in securing import licenses.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Zambian kwacha (K) to U.S. dollars at the rate of K1 = US$1.2675 for 1977 and US$1.2307 for 1978, as shown in International Financial Statistics, v. 33, No. 1, January 1980, p. 426.

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The Mineral Industry of Other Central African Countries

By Janice L. W. Jolly[1]

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CAMEROON

Owing to an upsurge in export earnings, Cameroon made substantial economic progress in 1978 and 1979. With a real growth estimated at 6%, the gross domestic product (GDP) for 1979 surpassed $5 billion.[2] Crude petroleum production was providing a new potential in 1978 and 1979 for achieving national self-sufficiency. Among other benefits, crude petroleum exports were helping to offset the escalating costs of refined petroleum imports and to reduce the 14% to 17% annual rate of inflation. Over the 4 years prior to 1978, Cameroon's petroleum imports increased by 12.1% in volume annually, while the import cost increased by 24.5% annually to about $105 million.

Total export earnings for 1978 were $805 million,[3] to which crude petroleum contributed $25.3 million and crude aluminum product exports contributed $25.9 million. Petroleum exports had increased to about $240 million in 1979 and were in third place after coffee and cacao. Total imports for 1978 were valued at nearly $1 billion. The volume of petroleum imports decreased in 1979 to 552,000 tons, compared with 622,000 tons in 1978. The European Economic Community (EEC) countries purchased over 75% of total Cameroonian exports and provided most of the Nation's imports. The United States purchased $12.4 million in petroleum exports from Cameroon in 1978. Domestic consumption of aluminum metal from imported Guinean alumina continued to grow; thus exports of this metal to France (valued at $2 million in 1978) and Japan continued to fall. Production and exports of cassiterite by the Société de Fibre et de Mecanique (SOFIMEC) continued to decrease. Gold production increased in response to the Department of Geology and Mines program for purchasing gold from small workers.

Cement was being produced from two plants, one serving southern Cameroon at Bonaberi near Douala, and one serving northern Cameroon at Fiquil. In 1979, Cimenteries du Cameroun (CIMENCAM), whose principal shareholders were Société Nationale d' Investissement du Cameroon (SNI) and Finsider International, received $30 million in loans from the European Investment Bank, Caisse Centrale de Cooperation Economique (France) and the Banque de Developement des Etats de l'Afrique Centrale (BDEAC) for increasing clinker and cement production. Both plants were to be expanded. Capacity at the Bonaberi clinker crushing works was to be increased from 480,000 tons per year to 870,000 tons per year, and capacity at the Figuil cement works was to be increased from 70,000 tons per year to 100,000 tons per year. Domestic demand for cement will exceed current cement production by early 1980. The new Figuil plant was to come onstream in 1982 and the Bonaberi plant in 1983.[4] Cement clinker imports increased in 1979 to 391,763 tons, compared with 329,660 tons in 1978. Cement was also produced from locally produced limestone. The price of cement in Douala was $105 per ton in early 1979 and $141 per ton in Yaounde, compared with 1978 prices of $83 per ton and $121 per ton, respectively.[5]

Crude petroleum production began in late November 1977 from the Kole offshore field in the Rio del Rey permit area, and by October 1978 from the Betika Marine and Ekoundou-Sud Marine fields; all permits were owned 51% by Elf-Serepca and 49% by the Shell Oil Company affiliate Pecten Cameroun. Elf-Serepca was a joint venture with the French Société Nationale Elf Aquitaine and the Cameroonian Government. In conjunction with becoming an oil producer, Cameroon was also constructing a petroleum refinery. The National Refining Company of Cameroon (SONORA) was to spend $255 million to build the 15-million-barrel-per-year refinery, which was expected to be completed in 1981. SONORA was composed of 66% Cameroonian Government, 10% Total Afrique, 8% Mobil International Petroleum Corporation, 8% Elf Aquitaine, and 8% Pecten Victoria Company. In addition to the refinery, a deepwater port facility with access to the refinery and a petrochemical facility were planned.

Although it was still too early to estimate the commercial potential, new petroleum reserves were being added to the announcement in 1979 by Mobil Exploration Equatorial Africa Inc. that good quality light crude oil (42°API) and natural gas had been discovered offshore in the Sanaga Sud A-1 zone. Mobil was operator (54%) in the permit shared by Compagnie Francaise des Pétroles-Total of France (18%), Ocelot Industries Ltd. of Canada (16%), and Damson Petroleum Company of the United States (12%). Elf Serepca also announced two finds, both in the Rio del Rey permit. Wells Tanda-1 and Japane-1 showed oil and gas between 1,000 and 1,800 meters.

In December 1978, the Government of Cameroon passed two new petroleum laws governing exploration and production agreements and fees and taxes. A tax of 57.5% was set for production revenues, and the new production agreements were to allocate the Government a minimum of 40% of the production. The final percentage was to be a function of the size and cost of development of the producing field. All past agreements were to be renegotiated under the terms of the new laws.

In September 1978, the Société Camerounaise de Depots Petroliers (SCDP) was formed in compliance with a Government decree that each oil marketing company be required to maintain petroleum product reserves equal to 20% of the amount sold in the previous year. SCDP which was to manage and own all petroleum product storage and transportation operations, was composed as follows: 51% Cameroonian Government, 10% Mobil, 10% Total, 10% Shell, 8% British Petroleum (B.P.), 6% Azienda Generale Italiana Petroli (AGIP), and 5% Texaco Petroleum Company. SCDP was to increase petroleum storage capacity from the current 102,600 cubic meters to 250,000 cubic meters by July 1, 1981.

Planning for the development of Cameroon's mineral resources was well underway, and the Government was indicating an interest in attracting foreign investors to participate. Recent United Nations studies had indicated potential deposits of lead-zinc, rutile, barite, uranium, kyanite, copper, diamond, chromite, and cobalt, in addition to known undeveloped deposits of iron ore and bauxite. Diamonds were discovered in

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the alluvial deposits of tributaries to the Dja River, phosphatic and uraniferous formations between Lomie and Yakadouma, and uranium at Lolodorf. Prospecting for uranium also continued at Kitongo Cliff and Teno Valley. A close-spaced scintillometer survey was to be followed by drilling. Iron ore deposits near Mbalam, Menongo, and Nkout in southeastern Cameroon were estimated to contain over 1 billion tons of 45.8% iron as hematite in a belt some 50 kilometers wide. Iron ore reserves at Kribi were confirmed by the French Bureau de Recherches Géologiques et Minières (BRGM) at 120 million tons, and the ore had responded well to preliminary metallurgical testing. Confirmed bauxite reserves in northern Cameroon at Minim-Martap, southwest of Ngoundere, and also near Dschang were estimated at 1 billion tons of 43% alumina. Their development has been hampered by their remote location and lack of adequate transportation. Société des Etudes des Bauxite Du Cameroun, a Government joint venture with a number of international aluminum companies, was formed in 1970 to conduct feasibility studies on these deposits, which may not be developed in the near future because of the high expenditures required, estimated at over $1 billion. The United Nations Development Programme (UNDP) was continuing its airborne magnetic survey of the country. The BRGM was increasing its efforts in southwestern Cameroon. The mineral exploration effort was being jointly financed by France and the European Development Fund.

With an installed capacity of about 314 megawatts, Cameroon was the second largest producer of hydroelectric power in formerly French sub-Sahara Africa. It will become the largest producer in the region upon completion of the Edea Dam complex, which currently generates 95% of the total electricity. Major projects under construction were the Song Loulou Dam at Edea and the Lagdo Dam at Njock, which will add another 300 to 400 megawatts to meet growing needs of the aluminum and petroleum industries. About 70% of all electricity generated is consumed by the Edea aluminum smelter, which has a capacity of 55,000 tons of aluminum per year. With completion of the new dams, the smelter capacity will be increased to 80,000 tons per year.

Table 1.—Other countries of Central Africa: Production of mineral commodities

Country,[1] commodity,[2] and unit of measure	1976	1977	1978[p]	1979[e]
CAMEROON				
Aluminum metal, primary ---- metric tons	57,724	55,593	48,620	[3]43,200
Cement, hydraulic ---- do.	298,909	362,953	[e]350,000	360,000
Gold, mine output, metal content ---- troy ounces	251	182	[e]200	200
Petroleum, crude ---- thousand 42-gallon barrels	--	277	4,700	10,130
Pozzolana ---- metric tons	17,880	[e]17,880	17,500	NA
Stone:				
Limestone ---- do.	60,463	91,135	79,180	NA
Marble ---- do.	638	678	[e]700	NA
Tin ore and concentrate:				
Gross weight ---- do.	19	21	[e]20	30
Metal content ---- do.	10	14	14	20
CHAD				
Sodium carbonate, natural (natron), slabs (plaques) and broken ---- metric tons	5,000	[e]11,000	11,000	11,000
CENTRAL AFRICAN REPUBLIC				
Diamond:				
Gem[e] ---- carats	171,604	178,145	198,953	210,000
Industrial[e] ---- do.	114,403	118,764	85,266	90,000
Total ---- do.	286,007	296,909	284,219	300,000
Gold[e] ---- troy ounces	400	100	965	500
Uranium ore, metal content ---- kilograms	--	--	750	NA
CONGO				
Cement, hydraulic ---- do.	52,000	[e]50,000	50,000	50,000
Copper, mine output, metal content ---- do.	408	1,011	800	1,000
Gas, natural:				
Gross[e] ---- million cubic feet	13,000	7,000	7,500	9,000
Marketed ---- do.	533	310	[e]300	300
Gold, mine output, metal content[e] ---- troy ounces	6,300	7,000	7,000	7,000

See footnotes at end of table.

Table 1.—Other countries of Central Africa: Production of mineral commodities —Continued

Country,[1] commodity,[2] and unit of measure	1976	1977	1978[p]	1979[e]
CONGO —Continued				
Lead, mine output, metal content ---------- metric tons	2,544	2,368	4,235	8,000
Petroleum, crude ---------- thousand 42-gallon barrels	14,274	12,045	4,500	14,500
Potash, crude K_2O equivalent ---------- metric tons	256,521	135,500	--	--
Zinc, mine output, metal content ---------- do	5,301	5,266	4,800	5,000

[e] Estimate. [p] Preliminary. NA Not available.

[1] In addition to the countries listed, Equatorial Guinea and São Tomé and Principe, covered textually in this chapter, presumably produce modest quantities of a variety of crude construction materials (clays, stone, and sand and gravel), and may produce minor amounts of other mineral commodities (most notably gypsum, lime, and salt), but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[2] In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (clays, stone, and sand and gravel) presumably are produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[3] Reported figure.

CHAD

Except for minor production of natron, salt, clays, and local building materials in 1978 and 1979, there was no mineral production of significance in Chad. The long-smoldering civil war was escalating and spreading, despite several truces signed in early 1979. Chad's hope of becoming an oil producer was delayed as a result. Because of Chad's distance from the sea, and owing to the absence of any railroads, the costs of petroleum exploration and development have been high. Transportation has always been a principal impediment to economic progress in Chad. The United Nations Development Programme (UNDP) was to rebuild 470 kilometers of roads in the Sahel region of Chad, spending about $20 million.[6] The most promising area for road improvement was that which paralleled the planned crude petroleum line from the Sedigi oilfield to Ndjamena.

Plans for construction of the minirefinery (topping plant), the 350-kilometer crude petroleum pipeline, and the Ndjamena residual fuel powerplant were delayed indefinitely because of the escalation in the civil war in early 1979. About $65 million was estimated as necessary to complete these projects with funds obtained from the International Development Association (IDA), the Arab Bank for Economic Development in Africa (ABEDA), and the Central Fund for Economic Cooperation (CFEC). The refinery was to process 3,000 barrels per day and to be fed by wells in the Sedigi field. The Société D'Etudes et D'Exploitation de la Raffinierie du Tchad (Seerat) had been scheduled to begin construction of the refinery in early 1979. Seerat was owned 51% by the Chadian Government, 18.375% by Shell Oil Company, 12.25% by Exxon Corp., 12.25% by Chevron Oil Company, and 6.125% by Continental Oil Company (Conoco). Conoco was operator for the Sedigi Oilfield exploration and production, and Shell was to operate the pipeline and refinery. In early 1978, Standard Oil of California was operator for a group including Shell (50%), Conoco (12.5%), and Exxon (12.5%) that discovered oil near the town of Moundou in southeastern Chad. The well, Mangara No. 1, flowed at rates up to 1,875 barrels per day of 36° to 38° API, paraffin-based oil.[7] Reserves were estimated at 365 million barrels.

With United Nations assistance, the Government of Chad was doing detailed mineral exploration in the Mayo Kebbi Region of southwestern Chad. A rather poor gold deposit and some interesting nickel and uranium anomalies were discovered. Secondary yellow uranium minerals were observed in veins 0.5 to 1.0 meter wide, containing from 0.1% to 9% uranium. The uranium veins occur in granite at Lere and were thought to present a promising target for future exploration. Some interesting mineralized areas, including tungsten, tin, and uranium, known to occur in the Tibesti Mountains, but these have been unavailable for some time owing to the rebel offensive that captured that region in July 1977. The brines and evaporates of the Lake Chad Basin were the subject of a recent paper in Geochimica et Cosmochimica Acta.[8]

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CENTRAL AFRICAN REPUBLIC

In 1978 and 1979, the mineral industry of the Central African Republic, which consisted primarily of diamond and gold production, was laboring under conditions of a stagnant economy that had resulted from 14 years of neglect. At yearend 1979, 3 months after the coup that changed the government as well as the country's name (renamed from the Central African Empire), the economy was still far from recovering. The new Government inherited huge external debts, a disorganized administration, and a weak economy. Four major weaknesses needed to be addressed: the deplorable conditions of river, road, and air transport; inadequate state and foreign investment; bad management of public enterprises; and a neglected agriculture and mining base. Industrial equipment was worn out, and new capital was not yet entering the country despite favorable tax legislation for foreign investment. By late 1979, a major reconstruction effort had been drafted under the guidance and cooperation of France and the International Monetary Fund (IMF).

France was to lend some $6 million[9] to start the economic reforms. In a new balanced budget drawn up in collaboration with the IMF, the number of civil service personnel was to be reduced by about 6,000 and salaries were to be frozen, abusive tax and customs levies were to be abolished, debt settlement plans for past nationalizations were to be drafted, and state-run companies were to take on private partners. Under the reforms, fuel distribution was to be split up into several companies, because the state-dominated (60%) company Centra-Hydro had proven in 6 years of operation that it could not carry out the task on its own. A shortage of petroleum dominated the country's economic troubles. Funds were also allocated for a new public-private transportation company for the Oubangui and Congo Rivers, the counry's main means of transport to the Atlantic Ocean, via barge to Brazzaville and rail to Pointe Noire in the Republic of the Congo. Lesser quantities of imports come overland from Douala, Cameroon. The main road crossing the western part of the country was to be repaired, and the airport was to be improved.

The investment code of the Central African Republic provided liberal tax, tariff, and other benefits for foreign investors, but some nationalizations have occurred. Total foreign investment in 1978 was valued at about $130 million, of which French interests made up $80 million, Portuguese interests $14 million, and U.S. and Belgian investments $7 million each. United States, Israeli, and Belgian diamond interests accounted for 14% of foreign investment. The U.S. company Diamond Distributors International (DDI) has invested $6 million in a buying office and cutting factory. Operating from New York, DDI was operating a diamond cutting industry through a Government mixed enterprise. This partnership, the Comptoir National du Diamont, was allocated 5% of raw diamond production and was the exclusive processor of gem-quality diamonds in the country.

Total exports for the Central African Republic were valued at $78 million compared with $89 million for 1977 and $62 million for 1976. Total imports (c.i.f.) were valued at $57 million compared with $70 million in 1977 and $48.3 million in 1976.[10] The volume of imports declined in 1978 because of both transportation difficulties and deteriorating terms of trade. Imports were largely petroleum and industrial and consumer goods. The Central African Republic's leading trading partner was France with 43% of total imports and 53% of non-Union Douaniére et Économique d' Afrique Central (UDEAC) imports. The Federal Republic of Germany, Japan, Belgium, and the United States were also primary suppliers. Among countries importing diamonds, Belgium was first with $16.4 million in uncut diamonds and $1 million in cut diamonds. The United States was second ($5.2 million in uncut diamonds), and Israel was third ($2.8 million). Lesser amounts went to France (1,018 carats), the Netherlands (10,106 carats), and Great Britain (2,632 carats) in 1978. The Central African Republic obtained petroleum products from Gabon under arrangements that included a loan-grant agreement with Iraq and shipments by the Congolese State-owned Centra-Congo company. Petroleum imports have been irregular since the nationalization of foreign company interests in 1974. Owing to payment difficulties with the Congo and the slowdown in river transport, imports have come increasingly overland by Cameroon. As a result, prices for imported goods escalated. The decline in export value for 1978 was due primarily to reduced prices for agricultural products. Lower revenue from basic commodities was offset somewhat by increased world diamond prices, which drove the average price per carat for diamonds from $79 in 1977 to $135 in 1978.

Diamond production was valued at $45.6 million for 1979, $39.7 million for 1978, and $23.4 million for 1977. The increase in value was due entirely to an increase in market prices, and was not a reflection of increased production. To the contrary, since 1968, when 609,360 carats were produced, there has been a steady decline to less than half that amount by 1978. Industrial diamond production represented approximately 20% of the value received for 1979. Of the total 1979 production, 4,299 carats, valued at $2.8 million, were cut locally. Cut diamonds exported in 1978 were valued at $1.8 million, compared with $660,000 for 1977. Gold production in 1979 was valued at $5.4 million, a considerable increase over the $500,000 earned for 1978. A small amount of uranium was produced in both 1978 (0.75 tons U_3O_8) and 1979 (1.25 tons U_3O_8). [11] The ore was shipped to France for processing at a pilot plant. Commercial exploitation had not yet begun.

Development of the Bakouma uranium deposits continued with small shipments of ore being sent to France for preliminary testing. The Société de l'Uranium Centrafricain (URCA) was formed in 1975 as a joint venture with the Central African Empire Government (33.3%), Swiss Aluminium Ltd. (Alusuisse) (33.3%), Compagnie Francaise des Mines d'Uranium (16.7%), and the French Atomic Energy Commission (16.7%), and had exclusive uranium mining rights in the Central African Republic. Cost of developing the mine was estimated at $400 million, including an open pit mine and processing facilities. In April 1979, France contributed an initial $1.7 million for the first stage of site construction. Uranium reserves were estimated at 17,000 tons U_3O_8 in phosphate-bearing ore. Samples tested by Alusuisse averaged 0.3% uranium in the phosphate ore. Nearby lignite deposits were to be utilized to provide electric power for the project.[12]

PEOPLE'S REPUBLIC OF THE CONGO

Petroleum continued to be a major contributor ($185 million)[13] to the Congo's gross domestic product (GDP), estimated at $895 million for 1978.[14] Maufacturing, including cement production, accounted for about 10% of the GDP. The petroleum refinery was still inoperable. Some natural gas was produced and copper, lead, zinc, and some gold were mined, but potash production was never resumed after serious flooding closed the mine in 1977. Hopes for improvement in the mineral sector were raised by the startup of the Soviet-built lead concentrator at Mfuati in 1979, and by encouraging resuls from increased petroleum exploration. At the end of 1978, proved oil reserves stood at about 746 million barrels, compared with 465 million barrels at the end of 1977. Petroleum revenues were also increasing as prices rose and production from new fields started. A new constitution and government were voted in during July 1979, following which, in a major message to the nation, the new Chief of State earmarked the mining industry as an area in which the Government would specifically encourage private investment. The financial situation of most state enterprises had deteriorated over the past few years owing to overemployment, inadequate management, and declining productivity.

A serious development problem continued to be the lack of adequate transportation. High priority was being given to transportation projects necessary for the mining sector and to strengthening the Congo's role as an inland transportation corridor for the Central African Republic, Chad, and Gabon. The Agence Transcongolaise des Communications (ATC), a state enterprise that manages rail and river transport, was to receive considerable foreign aid for transportation improvement. In 1973, the World Bank had approved a credit of $6.5 million for the expansion of the Congo-Ocean railway. Feasibility studies for improvement of the railway were done by Tecsul International of Canada, and tenders for the construction of a new route between Holle and Dolisie were awarded in 1978 to a French, German, and Italian consortium, and to Pandrol Ltd. of the United Kingdom for materials supply. Track was also renewed between Holle and Loubomo and between Holle and Fourastie, and the marshaling yards at Point Noire and Brazzaville were to be updated. Financing was to come from Canada, France, the African Development Bank, Saudi Arabia, and Kuwait.

Petroleum and reexported diamonds

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formed greater than 85% of the Congolese exports for both 1978 and 1979. Total Congolese exports for 1978 were valued at $235.4 million, and total imports (c.i.f.) at $261 million. Petroleum exports were valued at $347.4 million for 1979, a 58% increase compared with 1978 petroleum exports valued at $220 million. Diamond exports were valued at $5.5 million for 1977,[19] but were not a product of local mining.

Production levels at Emeraude, the largest offshore field, had decreased steadily from the peak production of 1974, and the field was expected to be depleted in the mid-1980's. Production began in 1977 at Loango (owned 35% by Elf-Congo and 65% by Azienda Generale Italiani Petroli Spa (AGIP)), and reached a level of about 20,000 barrels per day in 1978. Production at this field was expected to peak in 1980 and fall steadily thereafter as these resources also became depleted. Likouala, a new field located about 50 kilometers from Pointe Noire with recoverable reserves of about 72 million barrels, should reach full production of about 10.5 million barrels per year in 1981 and was to begin production at the rate of 4,200 barrels per day in 1980. With renewed Government encouragement, petroleum exploration activities increased. The outlook was also favorable that the Government-owned oil refinery at Pointe Noire would soon be operating. Negotiations were in progress with a French company for overhauling and operating the refinery. The State-owned company Hydro-Congo had the monopoly for distribution of petroleum products in the Congo.

Elf Aquitaine confimed the presence of exploitable petroleum by exploratory drilling in Sendji Marine-2 on the Pointe-Noire deepwater permit (Elf Congo 65%, operator; AGIP Recherches Congo, 35%). A second discovery was also made on a neighboring structure (Yanga) at Senji Nord Marine I, where petroleum was encountered at several depths, but the production potential was still to be determined. Congolese Superior Oil (operator, 25%), Canadian Superior Oil (25%), and Cities Service Congo Petroleum (50%) were awarded an offshore exploration permit for Marine-1 in 1979. Late in 1979, three U.S. companies also signed an offshore exploration agreement, leasing 40,000 hectares from Hydro-Congo. Under the terms of the agreement, the cost of exploration was to be reimbursed by production sharing. Accordingly, Hydro-Congo will get 50% of the production, Coastal Corp. (Houston) 22.5%, Agri Petco International Inc. (Oklahoma) 12.5%, and Ladd Petroleum Corp., 15%.

Production of lead concentrates from a lead-zinc-copper deposit at Mfuai started in 1979 and was expected to reach 30,000 tons of lead concentrates per year. Five years of reserves had been outlined. A nearby larger deposit was expected to support a production capacity of about 70,000 tons of concentrates per year over a 25-year period. Other sizable lead-zinc deposits have been discovered close to the Gabonese border. Société Minère de M'Passa's output of copper concentrates was unchanged in 1978 at 800 tons of contained metal, which was full capacity of the plant. Production of zinc at M'Passa fell to 4,800 tons of contained metal in 1978. No figures were available for Congolese gold production, which came mostly from the joint Soviet-Congo operation Société Nationale des Mines de Sounda-Kakamoeka (SONAMIS). About 6,430 troy ounces were believed to have been produced from the Magonise deposits, and about 570 troy ounces from other sources.

EQUATORIAL GUINEA

After a successful coup in August 1979, a new government was formed in Equatorial Guinea. In desperate need of economic assistance for revitalizing a country after years of political repression and economic neglect, the new Government moved to develop closer ties with several Western nations. Spain in particular was supplying $23 million for food, medicine, and technical aid. Equatorial Guinea was to have a new currency pegged to the Spanish peseta, and financial dealings were linked to Spain through the creation of the Banco Español de Guinea Ecuatorial y de España. Several aid agreements were also signed with France for economic, technical, and scientific assistance. France was expected to provide funds for work on the port of Molabo ($2 million), prospecting for minerals ($500,000), and the fishing industry. The Government was expected to prepare a new hydrocarbons law. In the meantime Spain's Hispanoil and the Equatorial Guinea Government formed a joint venture, Empresa Guineo Española de Petróleos (GEPSA), to explore for and produce hydrocarbons. No exploration work had been done since 1969, when Continental Oil Company withdrew after a border dispute between Equatorial Guinea and Gabon.

SAO TOME E PRINCIPE

Since proclamation of independence in 1979, the Democratic Republic of São Tomé e Principe has received aid from a number of international institutions and countries, including the U.S.S.R., Mainland China, Cuba, North Korea, the German Democratic Republic, Sweden, the Netherlands, France, and Portugal. Most of the aid has been in the form of technical assistance for public works, health, defense, and miscellaneous equipment. Portuguese cooperation also included highway and port construction and improvements to the air transport system. In 1978 and 1979, Portugal was the principal supplier and customer of São Tomé, purchasing mainly coffee and copra. In addition to agricultural assistance, the French have also done a study to set up a brickworks. A major shift in political stance in 1978 and 1979 led to greater emphasis being placed on consumer food production to reduce the massive imports of food, which had increased since independence. The most significant diplomatic move in 1978 was towards a closer relationship with Angola. In 1979, São Tomé joined Angola, Mozambique, Guinea Bissau, and Cape Verde at the first summit meeting of these former Portuguese colonies to decide on coordination of development policies.

Hidrocarbo, owned by Premier Consolidated through Ball and Collins (Oil and Gas) Ltd., remained the only exploration permit holder on the islands. Petroleum exploration contracts were renegotiated in early 1978.

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[1] Physical Scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Communité Financiére Africaine francs (CFAF) to U.S. dollars at the rate of CFAF225.64 = US$1.00 for 1978 and CFAF212.72 = US$1.00 for 1979.

[3] International Monetary Fund. International Financial Statistics. V. 33, No. 6, June 1980, pp. 100-101.

[4] Industrial Minerals (London). Cameroon, New EIB Loan for Cement Industry. No. 148, January 1980, p. 9.

[5] Direction de La Statistique et de la Compatabilité Nationale. Cameroon Bulletin Mensuel de Statisque. V. 6, No. 10, October 1979, pp. 2, 4.

[6] Where necessary, values have been converted from Communité Financiére Africaine francs (CFAF) to U.S. dollars at the rate of CFAF225.64 = US$1.00 for 1978 and CFAF212.72 = US$1.00 for 1979.

[7] Oil and Gas Journal. International Brief. V. 76, No. 11, Mar. 13, 1978, p. 48.

[8] Eugster, H. P., and M. Gilbert. Brines and Evaporites of the Lake Chad Basin, Africa. Geochimica et Cosmochimica Acta, v. 43, No. 7, July 1979, pp. 793-983.

[9] Where necessary, values have been converted from Communité Financiére Africaine francs (CFAF) to U.S. dollars at the rate of CFAF225.64 = US$1.00 for 1978 and CFAF212.72 = US$1.00 for 1979.

[10] International Monetary Fund. International Financial Statistics. V. 33, No. 6, June 1980, pp. 106-107.

[11] U.S. Embassy, Bangui, Central African Republic. Department of State Airgram A003, Mar. 8, 1980, 1 p.

[12] Mining Annual Review 1979. C.A.E. P. 490.

[13] Where necessary, value have been converted from Communité Financiére Africaine francs (CFAF) to U.S. dollars at the rate of CFAF225.64 = US$1.00 for 1978 and CFAF212.72 = US$1.00 for 1979.

[14] U.S. Embassy, Brazzaville, Congo. Department of State Airgram A-26, Sept. 28, 1979, 8 pp.

[15] International Monetary Fund. International Financial Statistics. V. 33, No. 6, June 1980, pp. 116-117.

The Mineral Industry of Other East African Countries

By David E. Morse[1]

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BURUNDI

Burundi, a small central African republic located between Tanzania and Zaire, remained essentially a nation of small family farms in 1978-79 with approximately 95% of the population engaged in subsistance agriculture. Coffee and tea continued as the nation's major export commodities. Mineral exports, small tonnages of cassiterite, wolframite and bastnäsite, accounted for an estimated 3% of total exports in 1978 and 2% in 1979, or $2 million[2] in both years. Burundi's major mineral imports in 1978-79 were cement, iron and steel, and refined petroleum products.

Abnormal weather conditions, a drop in world coffee prices in 1978, and the conflict in neighboring Tanzania and Uganda in late 1978 and early 1979 combined to restrict economic growth in Burundi during 1978-79. The gross domestic product (GDP) posted a gain of 6.7% in real terms for 1978 and an estimated 2.5% for 1979 which was significantly less than the 13.7% recorded in 1977, a time of high world coffee prices. The manufacturing and construction sectors were hard hit in 1979 by the conflict between Burundi's eastern neighbors because of transport disruptions which made building materials and manufacturing inputs almost unobtainable.

Fuel supplies fell drastically in 1979. In May, France, Belgium, and the Federal Republic of Germany helped set up an airlift to supply Burundi with fuels and vital supplies. The Mombassa (Kenya) to Bujumbura airlift was terminated in June as transport service through Uganda and Tanzania slowly returned to a more normal state.

In early 1979, the Burundi Ministry of Geology and Mines report entitled "Memorandum on the Development of Nickeliferous Laterite Deposits of Burundi" was released. The report included metallurgical studies, a peat energy study, an economic prefeasibility study and proposals for constructing a mining and smelting facility, and transport infrastructure including a rail link to the Dar es Salaam-Kigoma railroad at Uvinza, Tanzania. Burundi nickel reserves were reported at 300 million tons of ore with a nearly 2% nickel content and smaller values of copper, cobalt, and platinum. The United Nations (U.N.) Development Program funded a research project to study Burundi's extensive peat deposits near Akanyara.

The peat deposits were to be developed to provide an indigenous energy supply and to feed a domestic, peat-derived chemical complex. No major agreements to develop either the nickel laterite or peat deposits were announced in 1978 or 1979 although small-scale exploitation of four peat bogs by the newly formed Peat Office commenced in 1979.

Table 1.—Other countries of East Africa: Production of mineral commodities

(Metric tons unless otherwise specified)

Country and commodity	1976	1977	1978[p]	1979[e]
BURUNDI[1] [2]				
Clays: Kaolin	2,362	[e]2,500	[e]2,750	2,750
Columbium and tantalum ores and concentrates ... kilograms	4,000	[e]4,000	--	--
Gold ... troy ounces	426	[e]450	[e]450	450
Lime	622	[e]600	200	200
Rare-earth metals: Bastnäsite concentrate, gross weight	139	[e]140	NA	NA
Tin ore and concentrate:				
Gross weight	26	[e]30	[e]30	30
Metal content	17	[e]20	[e]20	20
Tungsten, metal content	2	[e]2	[e]2	2
ETHIOPIA[1]				
Cement, hydraulic	148,500	[r] [e]73,000	86,000	[3]92,757
Clays: Kaolin	45,000	[e]40,000	31,750	30,000
Coal: Lignite[e]	200	200	--	--
Copper:				
Gross weight	1,900	--	--	--
Metal content	[e]400	--	--	--
Gold, mine output, metal content ... troy ounces	11,253	7,725	[e]8,000	8,100
Gypsum and anhydrite, crude ... cubic meters	--	6,552	932	1,165
Petroleum refinery products:				
Gasoline ... thousand 42-gallon barrels	672	733	782	750
Jet fuel and kerosine ... do	198	--	240	250
Distillate fuel oil ... do	1,451	1,586	1,470	1,450
Residual fuel oil ... do	1,471	1,498	1,698	1,400
Other ... do	91	152	152	150
Refinery fuel and losses ... do	454	601	453	500
Total ... do	4,337	4,570	4,795	4,500
Platinum, mine output, metal content ... troy ounces	145	100	123	100
Pumice ... cubic meters	NA	5,000	NA	NA
Salt:				
Rock[e]	10,000	5,000	10,000	11,000
Marine	88,000	[e]75,000	50,000	55,000
Stone, sand and gravel:				
Limestone	8,500	[e]8,500	NA	NA
Sand ... cubic meters	NA	219,471	NA	NA
Other ... do	NA	959,180	NA	NA
LESOTHO[1]				
Diamond:				
Gem ... carats	891	7,576	13,611	14,000
Industrial ... do	4,125	34,514	53,611	56,000
Total ... do	5,016	42,090	67,222	70,000
Stone ... cubic meters	NA	18,572	25,000	25,000
MALAWI[1]				
Cement, hydraulic ... thousand tons	85	94	93	[3]105
Gem and ornamental stone: Agate[e]	4	4	4	6
Kyanite	[e]90	250	100	--
Lime	250	--	--	--
Stone: Limestone	149,254	116,653	140,885	115,000
MAURITIUS[1]				
Lime	7,300	7,500	8,000	8,000
Salt	5,500	6,000	6,000	6,000
Stone: Basalt, not further described	400,000	1,574,000	1,154,885	1,200,000

See footnotes at end of table.

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Table 1.—Other countries of East Africa: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Country and commodity	1976	1977	1978[p]	1979[e]
RWANDA[1]				
Beryllium: Beryl concentrate, gross weight	46	[e]55	58	19
Columbium and tantalum ores and concentrates: Columbite-tantalite, gross weight	45	64	48	50
Gas, natural:				
Gross million cubic feet	6	7	7	7
Marketed do	6	7	7	7
Gold, mine output, metal content troy ounces	936	1,814	1,125	1,100
Lithium minerals: Amblygonite[e]	30	30	28	28
Tin, mine output, metal content	1,605	1,598	1,502	1,500
Tungsten, mine output, metal content	432	568	385	386
SEYCHELLES[1]				
Guano	5,670	5,277	5,505	5,600
SOMALIA[1]				
Salt, marine[e]	2,000	2,000	2,000	2,000
SWAZILAND[1] [4]				
Asbestos: Chrysotile	41,847	38,046	36,957	38,000
Barite	369	--	--	--
Clays: Kaolin	989	--	--	--
Coal, bituminous	154,525	128,990	165,874	[3]168,409
Fertilizer materials, nitrogenous	NA	3,252	NA	NA
Iron ore, direct-shipping grade, gross weight thousand tons	1,744	1,441	1,266	(5)
Stone: Quarry product cubic meters	50,618	93,490	452,494	[3]247,090
Tin, mine output, metal content	2	2	1	1
UGANDA				
Beryllium: Beryl concentrate, gross weight[e]	[r]54	45	NA	--
Bismuth, mine output, metal content[e] kilograms	[r]5,000	3,000	1,000	5,000
Cement, hydraulic	87,600	80,000	[e]80,000	50,000
Columbium and tantalum ores and concentrates, gross weight[e] kilograms	2,100	2,100	2,058	2,260
Copper:				
Mine output, metal content	7,000	4,000	1,300	2,100
Metal, blister, primary	7,000	4,000	1,300	1,300
Fertilizer materials, phosphatic, crude: Apatite	[r]15,000	5,000	5,000	5,000
Iron and steel: Crude steel	[r]12,000	15,000	15,000	--
Lime, hydrated and quicklime[e]	20,000	20,000	25,000	28,000
Salt, evaporated[e]	500	500	500	500
Tin, mine output, metal content[e]	120	120	120	60
Tungsten, mine output, metal content	110	110	110	55

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (clays, stone, and sand and gravel) presumably are produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[2] Limited quantities of other pegmatite minerals may also be produced, but output is not reported.

[3] Reported figure.

[4] Data represent sales; actual production is not reported.

[5] Actual production was zero; sales from stockpiles totaled 493,528 tons.

DJIBOUTI

The Republic of Djibouti lies on the west side of the Bab-el-Mandeb, which connects the Red Sea and the Gulf of Aden. Formerly the French Territory of Afars and Issas, Djibouti received its independence in June 1977. The economy of the country was based on the commercial and maritime activity of the port of Djibouti and the operation of Chemen de Fer Franco-Ethiopian (CFE) which connects the port with Addis Ababa, Ethiopia. The country continued to be plagued by chronic unemployment and a severe balance of trade deficit in both 1978 and 1979. Subsidies from France and aid from Saudi Arabia and other Arab states helped to sustain the economy.

Djibouti had no significant mineral production although small, unreported quantities of crude construction materials undoubtedly were produced for local use. The potential for production of salt, gypsum, limestone, cement, and perlite exists but the small population (250,000) and distance from substantial markets for these low unit value commodities has deterred investment. The Bureau de Recherches Géologiques et Minières of France (BRGM) has explored the possibility of utilizing geothermal resources in the area of Lake Asal.

ETHIOPIA

The mineral industry of Ethiopia continued to be a minor contributor to the nation's economy in 1978-79. Evaporite deposits were worked for the production of gypsum and salt. Gold and platinum were recovered from alluvial workings. Stone and sand and gravel were mined throughout the country for local consumption. Ethiopia had two cement plants, a 14,000-barrel-per-day oil refinery that was being expanded with the assistance of the U.S.S.R. and several salt-producing facilities on the shores of the Red Sea.

The U.N. classified Ethiopia as one of the world's 10 least developed countries with a per capita income of approximately $100.[3] Ethiopia had a small modern sector and a subsistance agriculture sector that provided the livelyhood for 85% of the population and contributed approximately 65% to the gross domestic product (GDP). Agriculture produce provided 90% of the country's export earnings while 75% of industry was engaged in the processing of farm products.

During 1978-79, Ethiopia experienced a sharp economic deterioration. A breakdown of transportation and communications due mainly to internal strife, together with a loss of workers to the armed services adversely affected both agriculture and industry. Food purchases, added to the heavy expenditures for military equipment, placed a severe strain on the nation's balance of payments resulting in a steady decline of international reserves and an increase in foreign borrowing.

In October 1978, the Government launched a development campaign, the "Green Zemecha," which emphasised the reconstruction and restructuring of the economy. Short-term goals were the elimination of illiteracy and unemployment; long-term goals were to diversify the economy with agriculture and light industry aimed at import substitution. The development campaign had little or no effect on the country's economy performance in 1979 owing to a stagnation in export earnings and a sharp increase in the cost of imported fuels.

LESOTHO

The Kingdom of Lesotho is a small, very mountainous, land-locked nation of 1.22 million people, and is completely surrounded by the Republic of South Africa. The mining industry consisted of the production of diamond and crushed stone in 1978-79. Remittances from about 100,000 Lesotho nationals working in mines in the Republic of South Africa constituted over 40% of the country's gross national product (GNP) and were nearly equal to the gross domestic product.

Lesotho's only significant mineral export was diamond in 1978-79. Other important exports were wool and live animals. The Kingdom's main trading partner was the Republic of South Africa.

Diamond was produced by licensed diggers on a small scale and at the Letseng-la-Terai diamond mine, the nation's only real mining operation, by De Beers Lesotho Mining Corp. (Pty) Ltd. Production in 1978, the mine's first full year of operation, was over 67,000 carats. The Letseng operation employed approximately 800 people of which 680 were locals and 120 were expatriates. The Letseng Mine is one of the lowest grade diamond operations worked by De Beers with the average grade of only 3.46 carats per 100 tons treated. The mine was only economically viable because of the occasional large, high-quality gemstones recovered.

MALAWI

Malawi is a landlocked nation of southeastern Africa with virtually no natural resources other than a fertile soil and adequate rainfall. The mining industry in Malawi was essentially confined to the production of industrial minerals, the majority of which were consumed by the domestic market. The main product mined was marble for use in the manufacture of cement and lime. Agate was produced for export.

Small and/or low-quality deposits of a wide variety of minerals were known including asbestos, chromite, corundum, iron ore, kyanite, magnesite, nickel laterite, uranium minerals, and zircon, but were not economically viable for development in 1978-79. The Ngana Coalfield in the north near the Tanzania border, reportedly containing 14 million tons of reserves, was considered by the Government as an excellent prospect for development. Other areas considered for possible mineral development were the Kapirikamodzi vermiculite ore bodies and the Kangankunde Hill monzanite-strontianite deposits.

MAURITIUS

Mineral production on Mauritius Island contributed an estimated $5 million to the island economy in 1978-79. Minerals produced included stone (basalt), salt, and lime. The production and export of sugar was the island's most important economic activity followed by a growing tourist industry. Mauritius needs for fuels, cement, iron and steel products, and a significant volume of food had to be imported in both 1978 and 1979.

REPUBLIC OF THE COMOROS

The Republic of the Comoros, a volcanic archipelago in the Mozambique Channel between Africa and northwestern Madagascar, had negligible mineral production in 1978-79. Small amounts of unrecorded stone and sand and gravel undoubtedly were produced. No significant exploitable mineral deposits had as yet been discovered by yearend 1979.

The most significant event in the Comoros in 1978 or 1979 was a forced change of government in May 1978. In early 1979 the new Government successfully normalized relations with France, the Republic's former colonial power, which had suspended all financial aid when the Comoros made a unilateral declaration of independence in 1975. France and the Comoros reached an economic, financial, and monetary agreement, and a cultural and military agreement in 1979. France was to defend the islands if attacked and the Comoros were to export perfume ingredients (ylang-ylang, jasmine, and geranium) to France.

REUNION

The economy of Reunion, an island in the Indian Ocean approximately 640 kilometers east of Madagascar, continued to be dependent on the agriculture sector, primarily sugar, in 1978-79. Reported mineral activity was limited to the operation of a 200,000-ton-per-year cement clinker grinding facility although the production of crude construction materials undoubtedly took place. The island hosted about 495,000 persons and was an overseas territory of France which financed the islands major development projects that consisted mainly of infrastructure improvements. BRGM continued a program of geologic mapping and ground water surveys in 1978-79.

RWANDA

Mineral production in Rwanda in 1978-79 was, for the most part, slightly less than it had been in 1977, but exports of mineral products continued to account for approximately 20% to 25% of the nation's foreign exchange earnings. Cassiterite concentrate (tin) continued to be Rwanda's most important mineral product and second most important export commodity after coffee. Tungsten minerals, columbo-tantalite concentrates, beryl, and alluvial gold were the country's other significant mineral output.

Most of Rwanda's mineral industry was controlled by Société Minière du Rwanda (Somirwa), which was managed and owned 51% by Compagnie Géologique et Minière des Ingenieurs et Industriels Belges (Géomines) and 49% owned by the Rwandan Government. Somirwa's mineral products were marketed by Socitété Gèneral des Mines in Belgium. In March 1978, Somirwa began construction of a smelting plant at Kilgali which was to produce tin metal and tantaliferous slag from Rwandan cassiterite ores.

Rwanda's chief route for exports and imports through Uganda to the Kenyan port of Mombassa was severed late in 1978 owing to the conflict between Uganda and Tanzania. Although the route was opened and critical supplies began arriving in June 1979, the transportation dislocation required the use of high-cost air transport. Significant portions of Rwanda's exports of coffee, tea, and cassiterite, and all of its wolframite were transported by air. There was an acute shortage of motor fuels, lamp kerosine, and some food items in the first half of 1979 but a more normal supply by yearend.

In 1979, the United Nations Development Program (UNDP) completed a geochemical and radiometric survey which covered a significant area of the country. Airborn radiometric and magnetic survey of selected areas have also been carried out. Geochemical anomalies of tin, tungsten, zinc, and uranium were found which merited further investigations. The UNDP was to assist with the followup investigations and BRGM of France was working in a 2,100-square-kilometer area in the north-central part of Rwanda.

SEYCHELLES

Tourism and agriculture were the more important sectors of the economy of the Seychelles Islands in both 1978 and 1979. The approximately 100 islands, located north of Madagascar in the Indian Ocean, 1,000 kilometers from the east coast of Africa, host a population of 62,000 on 40 granite and 60 coralline islands which average less than 4 square kilometers in area. The only product mined in the Seychelles was guano which was valued at $271,000[4] in 1978 and $279,000 in 1979. The other reported mineral activity was offshore petroleum exploration by a group comprised of Burma Oil Seychelles, Ltd. (40%). Amoco Seychelles Petroleum Ltd., (20%) Hematite Petroleum Seychelles, Ltd., (20%), and Norcen International (20%).

SOMALIA

The mineral industry of the Somalia Democratic Republic continued to be a minor contributor to the nation's economy in 1978-79. Official figures for Somali mineral production and trade were not available for either 1978 or 1979, which required considerable use of estimates in table 1. Mineral production was limited to industrial and construction materials, solar evaporated marine salt, meerschaum (sepiolite), and small quantities of cassiterite (tin concentrate).

In early 1979, production at the 10,000-barrel-per-day Mogadiscio oil refinery was initiated. The Iraqi Fund for Foreign Development financed the project and crude oil was supplied by the Iraqi National Oil Co. A 100,000-ton-per-year cement plant was scheduled to come online at Berbera in 1978 but information concerning the plant's status was lacking and it was not known if the facility was operational by yearend 1979.

Somalia's fragile economy was severely strained in 1978-79 by an influx of approximately 1 million refugees from neighboring Ethiopia. The Somali Government's request for aid from the U.N. to feed and provide a minimum of shelter and other basic amenities for the refugees was met with a U.N. commitment of 159,000 tons of food and over $40 million[5] in nonfood aid.

SWAZILAND

Mineral production in Swaziland continued to be one of the country's major sources of income in 1978-79; however, mining's contribution to total export values has declined from 40% in the early 1970's to approximately 15%. Asbestos was the most important mineral commodity in terms of revenue followed by iron ore and coal. Alluvial tin and gold were produced on a small scale and unrecorded amounts of clays and sand were utilized by the domestic construction industry. Stone output increased considerably owing to increased road construction and improvements and building of a railroad link (90 kilometers) between Phuzumoya and the South African railway system at Labumisa.

Shipments of iron ore from the Ngwenya Mine continued in 1978-79 although mining operations were terminated in 1977. Exports of 1,266,000 tons in 1978 and 957,000 tons in 1979 were significantly less than planned due to rail problems at the port of Maputo, Mozambique. Utilization of the nation's large, low-grade iron ore resources continued to be studied by the Government

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including the possibility of producing sponge iron domestically.

Exports of asbestos fiber from the Havelock Mine were approximately 38,000 tons in both 1978 and 1979, and were valued at $19.5 million in 1978 and an estimated $20.2 million in 1979. The mine was owned by Turner and Newall Ltd. of the United Kingdom (60%) and by the Swaziland Government (40%). Significant efforts were made in 1978-79 to reduce dust levels in and about the 120-ton-per-day asbestos fiber plant.

Production of anthracite by Swaziland Collieries Ltd. at Mpaka increased in both 1978 and 1979. Coal was used by the Swaziland railway and by local industrial and agricultural consumers; small tonnages were exported to Mozambique. The Government continued to encourage greater domestic use of coal.

Coal exploration was continued by Shell Coal Swaziland (Pty.) Ltd. and by the Geological Survey and Mines Department of Swaziland. Shell completed an exploratory shaft and underground workings on the Mpulme anthracite deposits.

A 3-year, geochemical stream sampling and analysis of stream sediments program, funded by the Canadian International Development Agency, was completed in 1978. Preliminary results of the sampling program indicated that 10 areas have good potential for base metal mineralization. A more detailed study of these areas was to commence in mid-1980.

UGANDA

The mining industry as well as most sectors of the Ugandan economy had suffered a period of neglect, mismanagement and significant decline from March 1972 to April 1979. The country experienced a crisis period from October 1978 through yearend 1979. Ugandan exiles aided by troops from neighboring Tanzania invaded the country in late 1978 and succeeded in ousting the former ruler in April 1979. The economy remained in a chaotic state of flux throughout 1979. The new Government called for monetary, technical, medical, and military assistance to restore the nation to a solid economic footing.

The state of the nation's mining industry was uncertain as no official information had been available for a number of years. The Kilembe copper mine had been the nation's most important mineral venture. Beryl, cassiterite, wolframite, and bismuth had been mined on a small scale. Phosphate rock and crude construction materials were also mined and quarried for domestic use. Salt was produced by solar evaporation of lake and well brines.

Uganda has significant mineral potential. Approximately 2 million tons of cobaltiferous pyrite has been stockpiled at Kilembe.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary values have been converted from Burundi francs (FBu) to U.S. dollars at a rate of FBu90.0 = US$1.00.

[3] Where necessary values have been converted from Ethiopian Birr (B) to U.S. dollars at a rate of B2.07 = US$1.00.

[4] Where necessary values have been converted from Seychelles rupees to U.S. dollars at a rate of SRs6.4 = $1.00 in 1978 and SRs6.50 = US$1.00 in 1979.

[5] Where necessary values have been converted from Somali shillings (Ssh) to U.S. dollars at a rate of Ssh6.23 = US$1.00.

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The Mineral Industry of Other West African Countries

By Phyllis Lyday[1]

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BENIN[2]

Mining did not contribute significantly to the economy of Benin, a small country on the coast of West Africa, during 1978-79. During these years, Benin continued to be rated by the United Nations as one of the 25 least developed countries in the world; its gross domestic product was under $200[e] per person per year. Salt from seawater, sand and gravel, bricks, and imported clinker for cement were the only minerals which contributed to the economy. Minerals were not expected to play an important role in the commercial sector of Benin's economy during the next decade.

Joint projects included infrastructure development to create a coordinated road and rail system between Niger and Benin that was begun in 1960 as "Operation Hirondelle." In 1976, an agreement for the construction of a rail link from Niamey, Niger, to Parakou was signed. At Parakou, the rail line would join the existing line to the port at Cotonou. Construction of the rail line was expected to take 6 years, and the cost was estimated at $287 million in 1979. During late 1979, the Federal Republic of Germany granted Benin a loan of $12 million for reconstruction of the port at Porto Novo. Benin and Nigeria were discussing a joint adventure in crude salt exploitation.

Exploration included proven deposits of asbestos in a zone between the ninth and tenth parallels by the Bureau de Recherches Geoligiques et Minieres (BRGM). Phosphate deposits from the Tapoa deposits of Niger, which extend into the Mekrou sector of Benin, were explored but were not considered to be commercially viable at the time of the exploration. An increase in the price of gold stimulated renewed interest in the Perma alluvial gold deposits. These deposits contain from 0.5 to 2.5 grams of gold per cubic meter.

During 1978, expansion of the 200,000-ton-per-year clinker grinding plant of Societe Nationale des Ciments (SONACI) to 400,000 tons per year was inaugurated. Cement production was marketed internationally by the Societe Benionoise de Materiaux de Construction. A second cement clinker project was planned for Onigbolo in eastern Benin, near Pobe, by Societes des Ciments d' Onigbolo (SCO). This project would use local raw materials and was expected to have a capacity of 500,000 tons per year. Approximately 100,000 tons per year was expected to be used locally, and the rest was planned to be exported. SCO was owned by the Government (49%), Niger (41%), and Denmark's F.L. Smidth & Co. A/S (10%). Construction was to be undertaken by F. L. Smidth, with a planned completion date of 1982. Henry Pooley Alkins (United Kingdom) was selected to monitor the construction. Arrangements were made for SCO to be financed by Denmark and Belgium-Luxembourg ($50 million) and by Nigeria and Benin ($20 million). The Arab Bank for Economic Development in Africa (BADEA) also contributed $8 million to the Onigbolo project.

The Seme oilfield, discovered in 1968 by Union Oil Co. (United States), was located 15 kilometers offshore. Reserves estimated at 22 million barrels were planned to be developed by Saga Petroleum (Norway) and Kvaerner Industrier A/S (Norway). Under the operating agreement, the Government retained ownership of the crude. The cost of the project, estimated at $98 million, was to be financed by Norwegian loans (90%) and the Benin Government (10%). Production was expected to begin in 1981, peaking at 15,000 barrels per day, which was expected to be exported. Benin's 3-year plan (1978-81) included $215 million for a refinery, but, in light of the fact that Benin consumes only 100,000 tons of petroleum products per year, this project may not be of primary importance.

CAPE VERDE

The Republic of Cape Verde consists of 16 islands of volcanic origin, 9 of which are inhabited by approximately 300,000 people. The islands are located in the central Atlantic Ocean, some 620 kilometers west of Senegal on the west coast of the African continent. The country gained independence in 1975 and was still in the process of establishing institutions and infrastructure during 1978 and 1979.

Cape Verde had an estimated gross national product of $179 per person during 1978. The Government's budget for the 1978 fiscal year included expenditures of $63.5 million against revenues of $55.8 million. Foreign assistance continued to provide the basis for the continued economic well-being of Cape Verde during 1978 and 1979. The United States continued to be a major donor, followed by France, the Federal Republic of Germany, the European Economic Community, the United Kingdom, and Portugal. Major U.S. aid projects to Cape Verde outside the agricultural sector were water desalination and electrical generation plants for the island of Sal and the city of Mindelo on the island of Sao Vicente.

Mineral production in the form of salt accounted for 6% of the export revenues. Production was from two solar drying pan facilities on Sal Island. Pozolana (a volcanic rock used in cement production) production from the island of Santo Antao was suspended during 1978 and 1979. Other mineral deposits in Cape Verde include gypsum on the Mao Island and lime on Boa Vista Island.

THE GAMBIA

The Gambia consists of 11,300 square kilometers of land ranging from 11 to 32 kilometers wide and extending 320 kilometers along the Gambia River into the interior of West Africa. The population in 1978 was approximately 538,000 people and income was $292[4] per person per year.

Banjul, the capital, is located in a natural harbour on the mouth of the Gambia River. Future development in Senegal could lead to mineral related traffic on the river, which was navigable for 240 kilometers. A $6 million hydroelectric powerplant was planned to be built at the mouth of the river near Koter and was expected to be operational by 1981. The African Development Bank granted a loan for the project. The Berretc Dam, which was begun in 1977, was expected to be completed by June 1980.

During 1978-79, Chevron Overseas Petroleum Co. (United States) and the French company, Compagnie Francaise des Petroles (CFP), obtained a 2,500-square-kilometer offshore area that included all of the Gambia's offshore waters up to a distance of 48 kilometers from the coast. Chevron's share in this holding was 75%, and CFP's share was 25%. Chevron-CFP completed seismic studies, and a well drilled by the Norwegian ship Pelcrin to 3,000 meters in water 700 meters deep was dry. The overall investment at yearend 1979 was reported to be $8 million.

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GUINEA

During 1978 and 1979, Guinea, a crescent-shaped country in the west African "bulge," was on its way to becoming a major economic force in Africa. Bauxite and alumina accounted for about 23% of the country's 1978 gross domestic product of $1,209 million[8] and 95% of the total 1978 export revenue. A policy change had been initiated to encourage investment by foreign firms; the aim of this change was to secure foreign markets, capital, and technology. Foreign investment was a primary factor in the expansion of the mineral sector. Guinea owned all the mining facilities for which it contracted loans, and repayment of the loans was from mine production. All mining projects included the training of Guinea technicians.

Revenue from bauxite continued to increase, and a mineral export tax that was first levied in 1974, based on the price of aluminum ingots and the alumina content of exported bauxite, continued to be collected. Export revenues came from the major bauxite deposits of Boke-Sangaredi, Kindia, and Fria. Guinea maintained its position as the third largest producer of bauxite in the world during 1978 and 1979. Guinea's mining industry was founded on bauxite, but additional resources of iron ore, diamonds, and uranium were expected to continue to provide increased national income in the future.

Plans for expansion of the mineral industry continued during 1978, and by yearend 1979, the Government had announced that the Ayekoye alumina project had been given priority over all other mining projects. The Konkoure Dam and a proposed aluminum smelter at Fria were planned to become integrated projects. The Government asked all companies interested in the bauxite or alumina industries in Guinea to buy a portion of the 1-million-ton-per-year output of Ayekoye. The success of the bauxite industry resulted in plans for two additional bauxite projects at Dabola and Tougue. Planned and present production for various bauxite corporations in Guinea are given below:

Company	Production (million metric tons per year)		Date	Deposit	Reserves (million metric tons)	Content	
	Present	Planned				Al_2O_3	SiO_2
Societe d'Enonomic Mixte Friguia (Friguia)	2.2	4.4	1983	Frai-Kimbo	[1]650	45-48	2-3
Offices des Bauxites des Kindia (OBK)	2.5	4.5	1982	Debele-Kindia	[1]200	48-52	2-3
Compagnie de Bauxites de Guinee	.9	NA	1978	Boke-Sangaredi.	[2]700-900	60-61	NA
Societe Guinea-Arabe d'Alumine et d'Aluminum (ALUGUI)	NA	.4	1980	Boke-Gaoual	[3]150	47-50	2
Societe des Bauxites de Dabola (SBD)	NA	.5	1982	Dabola	[4]1,000	48-52	2-3
Societe Miniere de Participation Guinee-Alusuisse (SOMIGA)	NA	.2	1982	Tougue	[5]2,500	47-52	3-4

NA Not available.
[1] International Bauxite Association Quarterly Review V. 4, Nos. 2, 3, March 1979.
[2] Mining Journal. V. 291, No. 7477, Dec. 8, 1978.
[3] International Bauxite Association. Quarterly Review. V. 3, No. 4, June 30, 1979.
[4] International Bauxite Association. Quarterly Review. V. 4, No. 4, June 1979.
[5] U.S. Embassy State Department Airgram, A-21, Mar. 15, 1971, 3 pp.

A cooperative agreement was signed between the United States and Guinea during 1978; the two countries agreed to cooperatively prospect for bauxite and study the technical and economic data relative to bauxite extraction.

Expansion plans continued in the mineral industry. Depspite the recessed iron ore market, plans continued for a large iron ore mine along the Liberian border near Mount Nimba. Diamond concessions were awarded to a European company and a U.S. company for the mining and processing of diamonds. The signing of joint venture agreements by the two companies indicated that diamond mining, which stopped in 1975, would resume in the near future. Exploration continued for uranium and offshore oil, under contracts signed in 1977.

Other infrastructure developments related to the mineral industry included the building of a hydroelectric dam on the Kankoure River to furnish electricity for the exploitation of the Ayekoye bauxite deposit. The mine, factory, and hydroelectric dams were expected to cost over $1 billion. A planned trans-Guinean railway project, which would require 1,148 kilometers of track, would allow the exploitation of iron ore in the Simadou range and bauxite at Tongue and Dabola. A feasibility study on the railroad was conducted by the Japanese firm of Nippon Koei Co. Ltd.

The most important mining project in Guinea during 1978 was the Mount Nimba iron ore project. The orebody consisted of two high-grade deposits, the Pierre-Richard and the Sempete. Due to a negligible stripping ratio (less than 0.5 overburden to ore), exploration by the Mifergui-Nimbu Co. (MIFERGUI) was concentrated in the southwest section of the Pierre-Richard deposit. This deposit contained estimated reserves of 600 million tons of 65% iron ore.[6] Exploitation was expected to be concentrated at the most homogeneous southeastern section for the first 10 years of production. The primary crusher was planned to be located between the two deposits, and treatment was expected to be confined to crushing, milling to 6 millimeters, classification, and desliming, to produce a 0.15-millimeter sinter feed. Screening was planned to be by the wet process. The Guinea Government had a 50% interest in the project. The balance was shared among the governments of Liberia, Nigeria, Libya, and Algeria, together with the following foreign firms: Nichimen Co. Ltd. (Japan); Usinor Exploration S.A. and Somer (France); National Institute of Industry, Sierra Nemare, and Cofei, (Spain); Mineralimpex (Romania); and Energoprojekt (Yugoslavia). Kaiser Aluminum and Chemical Corp. (United States), which carried out the feasibility study in 1978, withdrew from the project. The Nimba project will be served by the existing Liberian American-Swedish Minerals Co. (LAMCO) railway for 10 years with the addition of a 17-kilometer spur under an agreement signed with the Liberian Government.

Except for the Nimba project, all other iron and bauxite projects depend on the building of a trans-Guinea railway. The annual capacity of the Mount Nimba mine was expected to increase from 15 million tons per year to some 25 million tons per year upon completion of this railway. The Mount Nimba project was expected to cost $800 million, with production estimated at about 15 million tons per year by the end of 1980 on a "take-or-pay" system. There were still unresolved problems with financing from the International Bank for Reconstruction and Development (IBRD), which distinguishes between plant and infrastructure loan rates.

Compagnie Generale des Matieres Nucleaires (COGEMA), a French Government nuclear energy company, began exploration in 1977 for uranium in Guinea. COGEMA signed a joint venture agreement in March 1978 with Power Reactor and Nuclear Fuel Development Corp. (PRNC), a Japanese Government-owned company, and the Guinea Government. In December 1978, an agreement was signed with GOGEMA, PRNC, Azienda Generale Italiani Petroli Nuclear (Italy), and the Government. Plans were to use aerial photogrammetry and ground-level techniques in the area north of latitude 11 degrees, 50 minutes, including northern Fouta Djallon in central Guinea. Initial exploration field work was being carried out from helicopters, almost entirely during the dry season (December to May). The project's cost for exploration was put at $5 million.

Bauxite in Guinea occurs in lateritic-type deposits. The total reserves were estimated at about 8,200 million tons, of which about half were proven.

The Compagnie des Bauxites de Guinee (CBG) was the largest bauxite producer in Guinea. The Boke deposit ore body consisted of 60% to 61% Al_2O_3 over a 2-square-kilometer area. About 8 million tons, or 67% of Guinea's bauxite production during 1978, came from this mine. Plans were formulated to improve the shipping port at Kansar and the infrastructure and housing facilities at the mine at Sangaredi. Plans were to finance these improvements through an international loan of $15 million that was obtained during 1978 and guaranteed by the Guinea Government. Kamsar was the world's largest bauxite shipping port.

The second largest mine in Guinea was the Friguia bauxite mine and alumina plant located at Fria near the junction of the Badi and Konkoure Rivers. Mining operations at Fria required the removal of overburden 2 years before mining was begun to allow the silica to leach. The ore, which consisted of 48% Al_2O_3, was converted to alumina onsite and shipped to smelters in Africa and Western Europe. Production during 1978 was around 600,000 tons of alumina, which

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was 85% of the mine's operating capacity.

Swiss Aluminium Ltd. (Alusuisse) studied the possibility of building an integrated aluminum complex at Ayekoye in the Boke-Gaoual region of northwestern Guinea. The Ayekoye bauxite deposit was estimated to contain 195 million tons of ore with an average content of 47% alumina and possible resources of 500 million tons of ore.[7] The initial producton capacity at Ayekoye was estimated at 1 million tons per year by a company named Societe Guinea-Arabe d'Alumine et d'Aluminium (ALUGUI). Partners providing capital for the Ayekoye project included Guinea, Egypt, Iraq, Kuwait, Saudi Arabia, and Libya. One-half of the $2.4 billion in capital was attributed to the Guinea Government in return for the land and mining rights. The area of consideration was in the northwest corner of Guinea, near the Boke deposit of CBG. The project was planned to involve a first phase, a 1.2-million-ton-per-year alumina-bauxite export operation at the port of Kamsar, followed by a second phase, a 150,000-ton-per-year aluminum smelter powered by the proposed Konkoure hydroelectric dam. The total cost of the infrastructure was expected to be $1.3 billion.

Guinea and Alusuisse formed the Societe Miniere de Participation Guinea-Alusuisse (SOMIGA), which was developing the Tougue bauxite deposits. The initial capacity of the mine planned at Tougue was estimated at 8 million tons per year,[8] and this output was expected to be exported.

The Guinea Government and Energoprojekt joined with Algeria and Nigeria to form the Societes des Bauxites de Dabola (SBD) in 1973. SBD reported reserves of 1 billion tons of bauxite in the Foute Djallon region.[9] The initial capacity of a planned mining project there was set at 5 million tons per year, which was designated for export. In 1978, Reynolds Metal Co. became a partner to manage mine operations and was prepared to take 200,000 tons of alumina and 1 million tons of bauxite per year from this project. SOMIGA and SBD were merged by the Guinea Government because of their similarity of their projects to form a joint Alusuisse-Energoprojekt committee to study the feasibility of an aluminum refinery.

A planned $12 million cement factory designed to produce 200,000 tons of bagged cement per year from imported clinker received aid from (BADEA). The plant was expected to begin operating in 1980, and all of its anticipated output was designated for domestic consumption.

No diamond production was reported during 1978 and 1979. A new company, Association pour la Recherche et l'Exploration de Dimants et D'Or (AREDOR), was founded by the Guinea Government with the help of British and Swiss investors. AREDOR was prospecting a 30,000-square-kilometer concession in the extreme southwestern part of the country. The operating firm was the International Diamond Corp. (IDC) of the United Kingdom. Two other groups were reported to be prospecting for diamonds, in an area in upper Guinea that covers almost one-third of the country. Reserves in this area were estimated at 300 million carats, two-thirds of which could possibly be industrial-grade diamonds. Reserves were centered within a triangle between Kissidougou, Keraouane, and Beyla.[10]

Petroleum exploration continued during 1978 in the 44,000-square-kilometer offshore concession areas. Societe des Guinee des Petroles (SOGUIP) contracted with a consortium of foreign firms specializing in offshore drilling. These firms included Buttes International (United States), Naftagas Kombinat Naftne Industrije (Yugoslavia), and Total S.A. (France). CFP dropped out of the project in 1977. One dry hole was drilled during 1977, and a second well was scheduled to be drilled during 1979, but no results of the second drilling were known by yearend 1979. A second petroleum prospecting agreement was signed during 1979 between Union Texas Petroleum (United States) and the Government which established Societe Guineene des Hydrocarbons. Conakry was seeking partners for onshore exploration during 1979.

GUINEA-BISSAU

Guinea-Bissau had no important mineral production during 1978 and 1979. The only mineral industry in operation was a brick and tile plant that produced 50 tons per day for domestic use. The country's import value for 1978 exceeded its export value by 70%, leaving a trade deficit of $908,000.[11] During 1979, it was estimated that export receipts covered no more than 8% of the cost of imports. During fiscal year 1979 (January to December), the Government budget totaled $43.36 million, with a deficit of $17.17 million. Guinea-Bissau's deficit has usually been offset by grants and loans from donor countries.

Bauxite found in the Boe region near Lugajol in the 1950's was investigated by the U.S.S.R. between 1975 and 1978. Reserves were estimated at 500 million tons of low-grade (47% Al_2O_3) ore.[12]

During 1978, the National Company for Oil and Mining Research and Exploration (PETROMINAS), a State-owned company, was in charge of a study of the integrated economic development of the southern part of the country as well as feasibility studies regarding the processing of petroleum. Italian Petroleum Enterprise-National Hydrocarbon Agency (AGIP-ENI) was exploring for oil during 1978.

IVORY COAST

No mineral production was reported in the Ivory Coast during 1978 and 1979. Mining industry activity during the period was characterized by exploration programs carried out principally by Societe pour le Developpement Miniere de la Cote d'Ivoire (SODEMI) and by Societe Nationale d' Operations Petrolieres (Petroci). SODEMI continued electromagnetic airborne prospecting for uranium and sulfur deposits. The regions where the most intensive studies were carried out for uranium were Odieune, Boundiali, Touba, Daloa, M'Bahiakro, and Kong. SODEMI's exploration of sulfur deposits by geochemical methods was actively pursued south of Touba. Also, SODEMI was considering a drilling program for uranium on the basis of geochemical prospecting at Kugbelo, Ira, Gouoplen, Godoufouma, and Silakoro. Other activities of SODEMI included projects in association or under agreement with private mining companies. These activites included a geophysical survey in the northern part of the Ivory Coast which was scheduled to be concluded at the end of 1979 and a similar survey in the southern part of the country which was planned to take place in 1980.

Petroci became interested during 1979 in the search for radioactive minerals. Its program consisted of spectrometric exploration at ground level, both in four-wheel-drive vehicles and on foot. By the end of 1979, no details of Petroci's findings were available.

With gold prices at an all time high, the gold deposits at Ity, 60 kilometers west of Main, became more economically viable. A consortium established to exploit this deposit continued its exploratory activity during 1979, and there was a strong possibility that the deposit would be mined in the 1980's.

Diamond mining was resumed in March 1979 by the Societe Franco-Ivoirienne Tortiya at the old workings of the Tortiya deposits and produced 48,000 carats by the end of 1979. Operations at the Tortiya deposits had ceased in 1975, after the successful operation of the Societe Anonyme de Recherches et d'Exploitations Minieres en Cote de Ivorie (SAREMECI) for almost 27 years. SAREMECI was forced to close between 1975 and 1979 because of the high cost of operation, whereas in 1979, the new company seemed to be more successful because of high diamond prices.

Petroleum production that was scheduled to begin during the summer of 1980 became a reality in the latter part of 1979 when the Esso-Shell-Petroci's offshore Belier oilfield tested flows ranging from 2,900 to 4,900 barrels per day. The oilfield was located 35 miles southwest of Abidjan, in water ranging from 300 to 2,400 feet deep. Also in this field, natural gas was tested at rates of from 1.25 to 2.1 million cubic feet per day. Previous discoveries made over the past 5 years, which were originally not considered to be commercially viable, seemed more economical in 1978-79. During 1979, the Ivory Coast imported 1.9 million metric tons of petroleum, mostly from Venezuela, Iraq, and Nigeria.

MALI

During 1978, the gross national product of Mali, at then-current prices, was estimated at $970 million.[13] Exports were valued at $96.6 million, compared with imports of $211.4 million. Twenty-five percent of Mali's foreign transactions were with other countries on the African continent. Transactions were limited by Mali's landlocked position in West Africa and the lack of infrastructure to the coast.

The investment climate for business remained favorable in Mali. Ordinance 26 of May 23, 1969, the Basic Code of Investments, was still in effect and offered certain incentives, mostly in the form of tax-free privileges for 5 to 10 years, to companies prepared to invest in areas of interest to the Government. Industries of interest included metallurgical industries and those involved in energy production. The Government required a 10% to 15% ownership interest for itself, and dealings were exclusively in the French language. Mali maintained a liberal system of payments and transfers in international transactions.

Construction continued on the Selinque Dam on the Sankarani River, a tributary of the Niger. The anticipated completion date of the project was August 1980, and its total cost was estimated at $142 million. The dam was designed to produce 66 million kilowatt hours of electricity for service to the area around Bamako.

The Senegal River Development Organization (OMVS), which included Mali, Mauritania, and Senegal, planned to build two dams to make the Senegal river navigable for over 930 kilometers. The cornerstone of the Diama Dam was laid in 1979, marking the completion of a project estimated to have cost $173 million. Construction of the Manantali Dam was planned to begin in 1980, and the total cost was estimated at $490 million. Abu Dhabi, Saudi Arabia, and Kuwait had pledged a total of $218 million to co-finance construction of the Mancintali Dam. Various other international agencies, including the European Development Fund and the African Development Bank, together with the Federal Republic of Germany, France, and Canada, have committed $225 million.

Other foreign investments and loans included a $6 million loan to Mali from the Central Treasury for Economic Cooperation (CTEC) to cover the Energy of Mali investment program and a $1.79 million CTEC loan to be used for the modernization of railroads and equipment. The project included the renewal of track and the rehabilitation of bridges to create an integrated line between Bamako in Mali and Dakar in Senegal.

The Federal Republic of Germany pledged $45.5 million to Mali for the period from 1979 to 1980. Projects planned to be included under this funding were development of the Sevare-Gao highway, exploitation of phosphate at Bourem, and studies of various mining and industrial projects.

The value of reported mineral production for 1978 and 1979, listed here respectively for each of the 2 years, included (cement, $5,000,000 and $2,500,000; gold, $169,000 and $272,700; salt, $135,000 and $135,000; limestone, $218,000 and $138,000; marble, $25,000 and $31,000; and granite, $135,000 and $33,000). Bauxite, diamond, iron, copper, nickel, manganese, thorium, platinum, petroleum, sulfur, bituminous coal, and uranium deposits of varying quality have been located, but the exploitation of these deposits was limited because of the lack of infrastructure, including power and transportation.[14] Investment in the minerals sector included financing by the Canadian Government for an airborne geophysical survey of the Liptako-Gourma area of Mali and Upper Volta under the Liptko-Gourma Authority which was supported by Mali, Upper Volta, Niger, and Togo.

A French-Malian agreement establishing a mining research syndicate was signed in December. Under the agreement, the Bureau de Recherches Geologiques et Minieres (BRGM) was to promote research and the exploitation of gold, copper, tin, diamonds, and other substances in Kenieba in southwestern Mali. BRGM also agreed to prospect for gold in the Kangaba and Bagoe regions (Bougouni-Sikasso). The first stage of the agreement left 70% of the funding to BRGM and 30% to the Malian Government. The cost of implementing this first stage was estimated at $718,000.

The U.S.S.R. was very active in mineral exploration and exploitation in Mali during 1978. In March, the U.S.S.R. and Mali signed a new trade agreement to replace a previous 17-year-old agreement. Three essentials of the agreement were as follows: Payments in convertible currency, freedom of merchandise exchange, and private sector participation in bilateral trade.

During 1978-79, traditional mining of gold continued on a small scale, but most of Mali's gold was mined by native women. Gold occurred in alluvial deposits in the Bale River and its tributaries at Ouassoulou, Faboulako, and Kalan (probable reserves of 4 tons).[15] Vein deposits, which required underground mining, occurred at the following locations: Kalana in southern Mali near the Guinean border (proven reserves of 30 tons);[16] Kodieran, which is 6 kilometers from Kalana (probable reserves of 7 tons);[17] and, in the Seventh Region, north of Kidal near the Algerian border. An alluvial deposit and a vein deposit were present near Kenieba in the First Region, on the border with Senegal.

The U.S.S.R. was assisting in starting gold mining operations in Kalana, near Sikasso, which were expected to produce about 400 kilograms in 1980. The ore averaged 35 grams of gold per ton, and proven reserves were estimated at 55 tons of contained gold metal.[18] In July 1979, the first

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stage of the Kalana I mine, which was owned by the Government and managed by the U.S.S.R., was almost complete. The total exploitation costs for the mine, up to year-end 1979, were $299 million. Its production capacity was estimated at 1,790 kilograms of gold and 49 kilograms of silver per year for 15 years.

Societe Nationale de Recherches et d'Exploitalion Minieres (SONAREM) and Soviet geologists had estimated proven reserves of 146 million tons of hematite ore containing 40% to 65% iron in the Bafing-Makana area, near the bank of the Faleme River opposite the Senegalese iron ore deposit.

Pechiney (France), Alusuisse (Switzerland), and mainland China were interested in bauxite deposits located in the southern and southwestern Mali (Balea and Sitaouma) near Keyes. The French National Service of Geology and Mining Prospecting (SGPM) and the private French company Societe Africaine de Recherches et d' Etudes Pour l'Aluminium, a branch of Pechiney-Ugine, carried out prospecting operations in the bauxite deposits. Probable reserves of 1,100 million tons of bauxite assayed at 45% Al_2O_3 with 3.4% silica were found.

The Federal Republic of Germany furnished Mali with a contribution of $165 million to finance a second cement plant in Kayes. Located 400 kilometers west of Bamako, the new dry-process cement plant was expected to be rated at 250,000 tons per year. The plant was scheduled to start operations by 1983.

A phosphate deposit 150 kilometers north of Gao, containing 25 million tons of 27% P_2O_5, was being mined by SONAREM during 1979. Production was estimated at 2,000 tons per year.

The Government had granted uranium concessions to three companies, two from France and one from Japan. Power Reactor and Nuclear Fuel Development Co. (PRNC), a Japanese firm, had expanded its original 1974 concession in the vicinity of Tessalit. The concession was in the region that borders Algeria and Niger. Also, sedimentary deposits north of Gao at Adrar Ti-N-Barakoye contained 0.48% U_3O_8.

The French company, Compagnie General des Matieres Nucleaires (COGEMA) had an initial concession near Mopti. COGEMA had discovered uranium deposits near Taoudeni in the Sixteenth Region and Kenieba (Kayes Region) near the Guinea border. COGEMA also had permits in Kenieba and Hombori-Douentza. BRGM had two uranium concessions; one was located along the Senegalese border and the other was along the Upper Volta and Niger front.

The largest U.S. directed investments in Mali were in the mineral fuel sector. Texaco Inc. had invested a total of $239 million in the Mauritania regions since 1970 and $1.1 million during 1978. Globe Oil Co.'s investments since 1973 totaled $269 million in the Menaka region. Mobil Oil Corp. invested $1.0 million in exploration during 1978.

A French company invested $52 million for a 5-year license in the Gao fault area. Elf-Aquitaine SA Societe Nouvelle (SNEA) became an operating partner with Murphy Oil Corp. in its Gao permit. This 50-50 partnership was expected to allow SNEA to expand its activites both in the Macina area and to the south. SNEA received exploration rights to 37,056 square miles in an Araouane permit and 33,899 square miles in a Macina permit. Investments of approximately $1 million were required. The Government's share was not known, although traditionally, the Malian Government has always sought to acquire large shares in prospecting oil companies.

NIGER

Uranium continued to be Niger's chief export, and Niger continued to be the world's fifth largest producer of uranium during 1978-79. The gross domestic product, at 1978 prices, was estimated at $681.3 million during 1978.[19] Uranium exports, in tons of metal equivalent, were valued at approximately 50% of the value of all exports. Anticipated growth was expected to increase the processed uranium at Niger's disposal and spur greater Niger participation in the world's uranium markets.

The economy of Niger continued to be handicapped because of the high cost of transporting goods which stemmed from Niger's landlocked position, poor roads, and absence of railroads. Construction, transportation, and related services accounted for over 30% of the 1978 gross national product. Niger's only mineral industries were a metal working firm, a chemical plant, a cement company, and two active uranium mines.

Societe des Mines de l'Air (SOMAIR) continued to mine uranium ore at its mine at Arlit. Reserves were estimated at 20,000 tons of uranium.[30] Increased production was attributed to the expansion of SOMAIR's capacity through the introduction of heap leaching and the doubling of design capacity throughout the solvent extraction section of the treatment plant.

During 1978, France bought 54% of Niger's exports, including 75% of its uranium output. Trade clients included the European Economic Community (EEC), Nigeria, the Arab countries, Pakistan, and countries of the West African Monetary Union. Foreign aid to Niger exceeded $173 million in 1978, and the bulk of it was given on a grant basis. Major aid donors were France, the United States, the Federal Republic of Germany, Canada and Saudi Arabia.

The Goverment's 3-year development plan was drawn to a close in December 1978. The first phase of the Kandadji Dam was completed, and six cities were electrified. Objectives were to develop known mining resources, continue research, and update mining and oil regulations. The Akouta mine began operation in 1978.

All uranium companies in Niger were asked to help finance the Tahoua-Arlit "Uranium Road." The Central Study Office for Overseas Equipment (BCEOM) was the supervisory construction contractor for this project. The Government viewed financial support of the road or similar development projects as a prerequisite for participation in uranium mining. The road was planned to connect Tahoua with Arlit through Agadez, and would be 656 kilometers long. Several hundred spanning construction projects were necessary because of poor drainage networks. Total costs were estimated at $200 million.

Production of a 70% concentrate of sodium uranate continued to be Niger's most important mineral commodity. Niger supplied 25% of COGEMA's production during 1978. Production from Niger in 1979 was expected to make up 30% of France's supply. Total known uranium reserves were estimated at 200,000 tons, and uranium production could reach 8,000 tons annually by the mid-1980's. The 60% increase in uranium prices between 1973 and 1977 provided a boost to Niger's economy.

Fluor Corp. and Drebs and Cie. had been contracted to undertake engineering-financial studies of the uranium reserves at the Imouraren deposit 100 kilometers south of Arlit. These reserves were estimated to contain 79,000 tons of uranium,[31] and this estimate ranked the Imouraren as the fifth largest deposit of uranium among those found in the market economy countries of the world. Partners in developing this deposit included ONAREM and Continental Oil Corp. (CONOCO) of the United States; ONAREM held a 30% share, and CONOCO'S share was 35%. COGEMA and CONOCO were both interested in acting as operators. Production was scheduled to begin in 1982, and the maximum production capacity was expected to be 3,000 tons of yellowcake per year.

A second mine, at Akouta, with a capacity of 2,000 tons per year, was located 10 kilometers south of Arlit. Production from 250 meters underground began in August 1978. The Japanese company, Overseas Uranium Resources Development (OURD), owned 25% of the mine, and the operator was Compagnie Mineire de l'Akouta (COMINAK). The other partners were ONAREM (31%), COGEMA (34%), and Spanish Nacional del Uranio (EUNSA) (10%). Reserves were estimated at 44,000 tons of uranium. The mine's production capacity was 1,500 tons of a 70% concentrate, with a maximum capacity of 2,000 tons anticipated in 1979. Jordisite, a molybdenum sulfide, was being processed from the Akouta mine's ore.

Societe Miniere de Tass planned to develop the Arni deposit within the COGEMA concession at Arlit. COGEMA and ONAREM were equal partners in this development. Reserves were estimated at 20,000 tons of uranium[33]. The processing capacity was planned at 2,000 tons of yellowcake per year.

Other uranium deposits planned for exploration included the Afasto-West deposit in the southwestern border of the Arlit concessions. This project was planned as an underground mine that would operate at 150 to 270 meters beneath the surface. Reserves were estimated at 30,000 tons of uranium.[34] Ownership was divided into thirds among ONAREM, COGEMA, and OURD. The Afasto-East (Techili) deposit northeast of Arlit was viewed as a possible replacement for the depleting SOMAIR mine. Reserves were estimated at 6,500 tons of uranium. Ownership included ONAREM (30%), COGEMA (30%), the Central Electric Generating Board (CEGB) (12%) of the United Kingdom, and Saarberg-Interplan Ges Fuer Rohstoff Energieing Techn MBH (12%) Federal Republic of Germany. Teguidda I-N Tessoum was a joint venture between International Resources S.A. (Japan) and ONAREM that aimed to develop reserves estimated at 15,000 tons of uranium[35]. Davey McKee Corp. (United

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States) planned to construct the facilities. The Djado project included ONAREM (25%), COGEMA (25%), Urangesellschaft (25%) (Federal Republic of Germany), and Power Reactor and Nuclear Fuel Development Co. (PRNC) (25%) (Japan).

Cassiterite, an ore of tin, continued to be mined in the Air Mountains at small placer works. Societe Miniere de Niger was the operating company, and mines were located at Taroudji and Timia. Cassiterite reserves were estimated to be 250,000 tons.[26]

The National Cement Plant (SNC) continued to be plagued by management and financial problems, and the domestic product cost 40% more than imported cement. The Government expected to continue to be the only buyer of domestically produced cement until plant capacity could be doubled with the financial and technical assistance of mainland China.

Extensive phosphate reserves in the Parc "W" Game Reserve were being evaluated by ONAREM with international assistance. Some blocks were reported to exceed 100 million metric tons of phosphate. Exploration 150 kilometers southeast of Niamey indicated 500,000 tons of phosphate rock that could be readily concentrated to 34% P_2O_5. Phosphate rock deposits were also present in the Tahoua Region, but no reserve figures were available.

During 1978, Esso Exploration Inc. (United States) resumed active exploration of its Niger permits. Indications of gas and oil occurred in the second well drilled, which was located at Ti-n-Toumma in the Niger basin of Lake Chad. Esso planned a third well 50 kilometers to the northwest of Yogou and a fourth well near the Termet Massif in eastern Niger.

Other activity in petroleum concessions included the cancellation of the exploration permit of Bishop Oil and Refining Co., Inc., (United States) by the Supreme Military Council. The French company, Elf-Aquitaine SA Societe Nouvelle (SNEA), was awarded three exploration licenses covering 345,528 square kilometers.

The first stage of a combination coal mine and electricity generating plant being built by Société Nigerien du Charbon (SONICHAR) was nearing completion at yearend 1979. Plans were for the electricity to be used in nearby uranium mines and Niger's northern city of Agadez. The cost was expected to exceed $125 million.

SENEGAL

The gross domestic product (GDP) of Senegal was estimated at $1,949 million in 1978[27] and $2,357 million in 1979. The industry and mining sector accounted for approximately 20% of Senegal's GDP. The country's deficit in trade was reported to be $254 million for 1978 and $238 million for 1979. At yearend 1979, the debt service stood at 15% of the value of exports and at 19% of the value of tax receipts. The rate of real growth of the economy averaged 2.7% during 1973-79.

Phosphate, attapulgite, and refined petroleum were the main minerals produced in Senegal for export. During 1978, there was a decline in phosphate rock prices on the world market. During 1979, the production and prices of phosphate rock mined in Senegal remained steady. The value of exported aluminum and calcium phosphate rock during 1979 was $65 million. Refined petroleum products accounted for 40% of Senegal's export earnings during 1978-79. New mineral projects included the building of a cement plant, a petrochemical fertilizer plant, a phosphate tailings plant, and an oil refinery; studies of iron ore deposits; production of natural gas for electricity generation; and increased exploration for petroleum.

The Faleme iron ore deposit, in eastern of Senegal, was the main mining project being considered by the Government. Reserves included 290 million tons of magnetic ores suitable for production of pellets and 120 million tons of rich ore (60% to 65% Fe) suitable for the production of lumpy ores and sinter feed. Total Faleme reserves were 410 million tons of magnetic ore averaging 40% to 50% iron.[28]

Bureau de Recherches Geologiques et Minieres (BRGM) (France) studied the possibility of modernizing and reopening the marble works in the Kedougou Region after a major deposit of high-grade marble was found. The deposit contained proven reserves of 350,000 tons and was estimated to contain as much as an additional 1 million tons.[29] The company formed to exploit the deposit consisted of the Government, Senegalese private interests, and BRGM. The International Development Association (IDA) provided financing.

Compagnie Senegalaise des Phosphates

de Taiba (CSPT), the country's leading producer of calcium phosphate, continued to operate the N'Doumour Diop open pit mine in the Tivaouane Region. Proven reserves were estimated at 20 million tons, and probable reserves were estimated at 50 million tons.[30] BRGM provided technical assistance through ownership in the Phosvalor Co. The planned development of a major phosphate mine at Tobene was postponed in favor of plans for the gradual expansion of the Taiba Mine.

CSPT and Societe Industrialle d'Engrais au Senegal each had a 10% share in a new fertilizer company named Industries Chimiques du Senegal (ICS). ICS planned to process 400,000 tons of phosphate per year.

Societe Senegalaise des Phosphates de Thies (SSPT), operator of the Pallo Mine, is the only world producer of aluminum phosphate used for conversion to clinker and sold as a slow-release fertilizer. During 1978, the company was operating below its capacity of 650,000 tons due to adverse market conditions. France, which imported 116,000 tons per year, was the principal importer; domestic purchases were approximately 34,000 tons. The remainder was calcined to clinker at Thies and exported. Studies were being conducted to investigate ways to upgrade the ore and transform it into phosphoric acid.

The government planned to develop a 50-million-cubic-meter deposit of gas that was discovered in 1959-60 at Diam Niadeo near Rufisque. Plans were for the gas to be transported via pipeline to the Cap des Biches powerplant to produce electricity. Societe Sengalaise de Distribution D'Energie Electric was in charge of building and operating the infrastructure.

Coastal States Gas Corp. (United States) had initiated talks with the Senegalese Government regarding construction of an oil refinery with a projected capacity of 5 million tons per year, at a cost of $400 million. Senegal's domestic oil needs of 1 million tons per year were met by the Societe Africaine de Raffinage refinery (SAR) in M'Bao, near Dakar.

TOGO

The 1978 gross domestic product of Togo, in 1978 prices, was $765.5 million.[31] Phosphate exports accounted for 38% of the country's export receipts during 1978. Between 1972 and 1978, Togo's economy showed real growth estimated at 5% per year, and the consumer price index rose 1.4%. A 33% increase in production that was planned for 1980 was expected to expand Togo's export earnings significantly.

Togo maintained an open-door and nondiscriminatory trade and foreign investment policy that allowed 100% foreign ownership. The investment code provided for tax holidays, customs exonerations, and profit repatriations. Togo was a member of the Lome Convention and received preferential treatment on exports to the European Economic Commission (EEC). Togo and the United States signed a guarantee of private investment agreement in 1952 and a treaty of amity and economic relations in 1966. Togo was also a beneficiary of the U.S. Generalized System of Preference (GSP) for imports, and one-third or more of Togo's exports qualified for duty-free entry into the United States under the GSP.

Commerce and services continued to expand at a brisk pace in 1978 with the expansion of the port at Lome, the near completion of the north-south international road network, construction of a glass factory, and the opening of a petroleum refinery. Because of its developed road network, efficient port, airfield, communication facilities, fully convertible currency, and virtual lack of import or foreign exchange controls, Togo was an opportune place for mineral investment.

Most of Togo's commercial energy was supplied by the Akosombo Dam in Ghana. The completion of a thermal powerplant in 1979, built in conjunction with a new steel rolling mill, fulfilled some domestic energy requirements. Other infrastructure developments included a United Nations Development Program and World Bank feasibility study of the hydroelectric potential of the Mono River near the Benin border.

The Office Togolaise des Phosphate (OTP) continued to sell Togo's high-quality phosphate rock at top world prices. Yugoslavia became the largest consumer of Togolese phosphate rock in 1978, taking over 450,000 tons. Other deliveries, made to Malaysia, Japan, Lebanon, and Nigeria, totaled 82,000 tons. The largest regional market was Western Europe where exports totaled 1.82 million tons in 1978. Belgium-Luxembourg, France, and the Netherlands were the three largest consumers in the Western European market.

In January 1979, National Steel Co. (NSC) opened a 100% Government-owned steel rolling mill in the industrial zone surrounding Lome. The mill's producton capacity was 20,000 tons per year of steel rod for use in reinforced concrete. Construction of the $37 million mill began in 1977. In 1979, the mill operated on domestic scrap, but, beginning in 1980, the mill planned to operate on imported scrap.

Societe des Cement de l'Afrique de l'Ouest (CIMAO), the cement clinker plant located 80 kilometers northeast of Lome and jointly owned by Togo, Ghana, and the Ivory Coast, was scheduled for completion in January 1980. The plant was expected to have a capacity of 1.2 million tons per year. Plant costs were projected at $221 million, with associated infrastructure costs of $71 million. Part of the infrastructure included an 80-kilometer railroad link from the deposit at Tabligbo to the port at Lome. The complex was expected to utilize large quantities of locally produced power and fuel. Financing was provided through the World Bank, French Caisse Centrale, the European Investment Bank, the Arab Bank for Economic Development in Africa (BADEA), and the Canadian International Development Association (CIDA), among others.

In 1978, Compagnie Togalaise des Mines du Benin (CTMB), a 100% Government-owned company, operated the phosphate mine and beneficiation plant at Kpeme. High-grade concentrate that averaged 36% P_2O_5 was sold to the Government marketing agency. Stocks at yearend 1978 were down to 113,000 tons. Togo planned to add a fifth 750,000-ton-per-year beneficiaton stream to the Kpeme plant by 1980, which would raise the total capacity to 3.75 million tons per year. A sixth line was planned for a later stage. A European-Tunesian banking consortium lent approximately $21 million to the Government for the expansion, which was estimated to total $40 million.

The Societe Togalaise des Hydrocarbures (STH) managed Togo's Government-owned 1-million-ton-capacity oil refinery. The refinery opened in January 1978 and operated until August. In April 1979, the refinery reopened, and by yearend, a total of 340,000 tons of refined oil was imported from Nigeria and processed into 320,000 tons of refined products. During 1978-79, there was interest in both onshore and offshore oil exploration in Togo. Ocean Resources (United States) was reportedly drilling offshore at yearend 1979.

UPPER VOLTA

Upper Volta remained a stable and democratic country in the interior of West Africa with no mineral production but vast reserves of manganese. During 1978-79, the country had the lowest per capita income in West Africa. Upper Volta's gross domestic product (GDP) grew at an average yearly rate of 5.8% during the post-drought period of 1975-78. The GDP, at then-current prices, was $826.7 milion[23] in 1978 and was estimated at $969.8 million in 1979. Large-scale foreign aid was necessary for virtually all development.

The lack of an effective transportation system hampered the development of Upper Volta's economy. International aid was received for both road and rail projects, but it was likely to be some time before mineral extraction would become possible. The Niamey (Niger) to Dori (Upper Volta) road was financed by the African Development Bank (AFDB). AFDB also financed $6.7 million for the construction of a road from Dori to Djibo at yearend 1979. Construction had begun on the Mango-Upper Volta and the N'Gourma-Niamey truck roads were completed.

Other infrastructure development plans included a dam at Pama that was expected to include a 71-megawatt turbine for electricity generation. Surveyor Leniger Cheverete of Canada was in charge of the feasibility study. The project cost was estimated at $497 million, and construction was expected to begin in 1980.

The Bureau Voltaigue de la Geologie et des Mines (BUCOGMI) was instrumental in setting up the Societe Voltaique d'Intervention Miniere a Petite echell (SOVINPEC). SOVINPEC provided marketing services for small mine workings where normal operations would be uneconomical. Mining possibilites existed in nickel, manganese, diamonds, copper, bauxite, lead-zinc, phosphate, marble, limestone, and stibnite.

Upper Volta attempted to open the P[illegible] gold mine 180 kilometers southwest of Ouagadougou. If opened, the mine would be operated by Societe de Recherche Miniere (SOREMI), which was owned by the Government (51%), Coframin (15%), and other shareholders. Feasibility studies indicated that the mine could have probable reserves

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of 2.15 million tons of gold ore containing 27.7 tons of gold. SOREMI indicated proven reserves of 15,000 kilograms of gold in Situ, plus 400 kilograms in the tailings from the original operation. It was estimated that 4 years of site preparation would be necessary before mining recommences.

Manganese deposits located in the northeast corner of the country contained 13.32 million tons of high-grade (51% Mn) manganese ore.[33] Exploitation of the deposit required the construction of a 360-kilometer rail spur from Ouagadougou, at a cost of $130 million. In addition to the spur, a satisfactory freight tariff for transporting the ore 1,150 kilometers to the new port at Abidjan, Ivory Coast, and infrastructure services would be required to mine the ore. In 1978, the international climate changed, and foreign investors were no longer interested in the Tamboa project because of high infrastructure expenses. A French subsidiary of Klockner-Ina of the Federal Republic of Germany was appointed to take over negotiations with foreign consortium members and financial backers. During 1979, Union Carbide (United States), which withdrew from participating in the project during 1977, showed renewed interest.

Other mineral-related projects included exploration of the 56-million-ton limestone deposit at Tin-H'Rassan by the Government with French assistance. In addition, a cement works at Ouagadougou was planned that was expected to have a capacity sufficient to meet domestic needs while also providing an excess for export to neighboring countries. Exploration of the marble and limestone deposits at Tiara started at yearend 1979. The Islamic Development Bank gave Upper Volta $97,000 to study the feasibility of a petroleum tank farm.

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[1] Physical scientist, Branch of Foreign Data.

[2] Prepared by E. Shekarchi, supervisory physical scientist, Branch of Foreign Data.

[3] Where necessary, values have been converted from Cummunaute Financiere African francs (CFAF) to U.S. dollars at the rate of CFAF209 = US$1.00 for 1978 and CFAF201 = US$1.00 for 1979.

[4] Where necessary, values have been converted from Gambian delasis (GD) to U.S. dollars at the rate of GD2 = US$1.00 for 1978 and GD1.8 = US$1.00 for 1979.

[5] Where necessary, values have been converted from Guinean sylis (GS) to U.S. dollars at the rate of GS20 = US$1.00, for both 1978 and 1979.

[6] Mining Journal (London), Guinea Looks Westward, V. 291, No. 7477, Dec. 8,1978, pp. 446-447.

[7] International Bauxite Association Quarterly Review on Member Countries: The People's Revolutionary Republic of Guinea. V. 4, Nos. 2 and 3, March 1979, pp. 35-40.

[8] Work cited in footnote 7.

[9] International Bauxite Association Quarterly Review, Member Countries: Guinea-Two Joint Venture Companies To Be Set Up. V. 4, No. 4, June 1979, p. 8.

[10] Mining Annual Review (London). Guinea. 1979, p. 497.

[11] Where necessary, values have been converted from Guinea-Bissau pesos (GBP) to U.S. dollars at the rate of GBP35 = US$1.00.

[12] U.S. Embassy, Bissau, Guinea-Bissau, State Department Telegram 9216, Mar. 2, 1977, 2 pp.

[13] Where necessary, values have been converted from Malian francs (MF) to U.S. dollars at the rate of MF440 = US$1.00 for 1978 and MF418 = US$1.00 for 1979.

[14] Bureau de Recherches Geologiques et Mineres (BRGM) (France) planned to publish "A Mineral Plan for Mali in 1980," which was expected to contain numerous maps of mineral deposits.

[15] Bamako L'Essor (Paris). Tomorrow Eldorado. July 5, 1976, p. 6.

[16] Work cited in footnote 15.

[17] Work cited in footnote 15.

[18] For background information, see the 1976 and 1977 editions of the United States Bureau of Mines Minerals Yearbook.

[19] See footnote 3.

[20] Sahel Hebdo Niamey. Satisfactory Results of Recent Uranium Exploration, September 1979, p. 8.

[21] Mining Magazine. Niger's Growing Role in Uranium Mining, V. 139, No. 2, August 1978, p. 100.

[22] Work cited in footnote 21.

[23] Work cited in footnote 20.

[24] Engineering and Mining Journal. Ongoing Projects: Niger-Rich Uranium Deposits. V. 189, No. 9, September 1979, p. 31.

[25] U.S. Embassy, Nimey, Niger. State Department Airgram A-18, Feb. 2, 1979.

[26] DEMAIN L'Afrique (Paris). Impact of Uranium on Economy Discussed. October 1978, pp. 61-70.

[27] See footnote 3.

[28] Mining Annual Review (London). Senegal. 1979, p. 496.

[29] See footnote 28.

[30] See footnote 28.

[31] See footnote 3.

[32] See footnote 3.

[33] Department of Mines International Report No. 53. Manganese, A Mineral Commodity Review, Dec. 21, 1979, 245 pp.

Table 1.—Other countries of West Africa: Production of mineral commodities

Country,[1] commodity,[2]	1976	1977	1978[p]	1979[e]
BENIN				
Cement, hydraulic metric tons	190,000	200,000	200,000	200,000
Salt, marine[e] do	150	[r]3	NA	NA
Stone: Gravel do	[e]16,000	NA	NA	NA
CAPE VERDE ISLANDS				
Cement, hydraulic[e] do	4,000	4,000	15,000	15,000
Pumice and related volcanic materials do	15,000	15,000	NA	NA
GUINEA				
Aluminum:				
Bauxite, gross weight thousand metric tons	10,848	10,841	10,456	12,500
Alumina do	560	562	610	660

See footnotes at end of table.

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Table 1.—Other countries of West Africa: Production of mineral commodities —Continued

Country,[1] commodity,[2]	1976	1977	1978^{p}	1979^{e}
GUINEA —Continued				
Diamond:^{e}				
Gem .... thousand carats	25	25	25	27
Industrial .... do.	55	55	55	58
Total .... do.	80	80	80	85
IVORY COAST				
Diamond:				
Gem^{e} .... thousand carats	22	^{r}7	--	--
Industrial .... do.	^{e}38	11	10	5
Total .... do.	60	18	10	5
Fertilizer materials, manufactured, mixed metric tons	44,500	^{e}48,000	^{e}48,000	48,00
Petroleum refinery products:				
Gasoline ... thousand 42-gallon barrels	2,193	2,166	2,210	2,20
Kerosine and jet fuel .... do.	1,101	1,388	1,117	1,10
Distillate fuel oil .... do.	3,595	3,235	3,678	3,60
Residual fuel oil .... do.	4,709	4,482	4,344	4,20
Liquefied petroleum gas .... do.	110	^{e}122	182	10
Refinery fuel and losses .... do.	490	^{e}451	521	50
Total .... do.	12,198	^{e}11,844	12,052	11,60
MALI				
Cement, hydraulic .... metric tons	^{e}50,000	35,174	34,400	36,00
Gold, mine output, metal content troy ounces	^{r}900	^{e}932	965	1,00
Salt^{e} .... metric tons	^{r}4,500	4,500	4,500	4,50
Stone:				
Granite .... square meters	NA	8,088	6,000	6,00
Marble .... do.	NA	217	400	40
Limestone .... metric tons	NA	394	495	50
NIGER				
Cement, hydraulic .... do.	36,240	40,000	^{e}40,000	^{e}39,00
Gypsum .... do.	^{e}2,588	^{r}3,000	2,720	2,73
Salt^{e} .... do.	1,000	1,000	900	90
Stone, sand and gravel:				
Limestone, not further described ... do.	56,456	60,000	NA	NA
Gravel .... cubic meters	^{r}179,268	^{e}180,000	^{e}180,000	100,00
Sand .... do.	^{e}5,937	^{re}6,000	^{e}6,000	6,00
Tin, mine output, metal content metric tons	126	130	125	15
Uranium concentrate, U_3O_8 content ... do.	1,460	1,440	2,060	3,10
SENEGAL				
Cement, hydraulic .... do.	386,000	330,000	357,000	^{e}394,00
Clays: Fuller's earth (attapulgite) cubic meters	^{r}4,627	3,405	6,930	7,30
Fertilizer materials, phosphatic:				
Crude:				
Aluminum phosphate thousand cubic meters	208	275	204	20
Calcium phosphate .... do.	1,591	1,596	1,555	1,50
Manufactured:				
Aluminum phosphate, dehydrated do.	68	69	48	4
Other^{e} .... do.	^{r}6	6	6	NA
Gold .... troy ounces	--	--	^{e}250	--
Petroleum refinery products:				
Gasoline ... thousand 42-gallon barrels	980	^{e}1,038	502	NA
Jet fuel and kerosine .... do.	932	^{e}666	616	NA
Distillate fuel oil .... do.	1,144	^{e}1,551	2,248	NA
Residual fuel oil .... do.	1,855	^{e}2,148	1,883	NA
Other .... do.	^{r}43	^{e}58	57	NA
Refinery fuel and losses .... do.	153	^{e}216	^{e}256	NA
Total .... do.	^{r}5,107	^{e}5,677	^{e}5,677	NA
Salt .... metric tons	141,953	140,000	140,000	140,00
Stone:				
Basalt .... cubic meters	168,500	^{e}168,500	100,000	NA
Marble (cipoline) .... do.	250	^{e}250	^{e}150	NA
TOGO				
Clays, for brick production ... metric tons	4,234	NA	NA	NA
Fertilizer material: Phosphate rock, beneficiated product .... thousand metric tons	^{r}2,908	2,857	2,827	2,90
Salt .... metric tons	^{e}200	--	650	60

See footnotes at end of table.

Table 1.—Other countries of West Africa: Production of mineral commodities —Continued

Country,[1] commodity,[2]	1976	1977	1978[p]	1979[e]
TOGO —Continued				
Stone:				
Granite metric tons	606	NA	NA	NA
Marble, dimension square meters	1,361	NA	23	NA

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[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the countries listed, the Gambia and Upper Volta, which are covered in the text of this chapter, presumably produce modest quantities of a variety of crude construction materials (clays, stone, and sand and gravel) and may produce minor amounts of other mineral commodities (most notably gypsum, lime, and salt), but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[2] In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (clays, stone, and sand and gravel) presumably are produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[3] Reported figure.

[4] Products marketed under the trade names "Balifos" and "Phospal."

Table 2.—Ivory Coast: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum metal including alloys, all forms:		
Scrap	--	41
Semimanufactures	1,317	1,123
Copper metal including alloys, all forms	629	708
Iron and steel metal:		
Scrap	17,576	19,606
Semimanufactures, including alloys	939	706
Lead metal including alloys, all forms	435	564
Zinc metal including alloys:		
Scrap	305	110
Semimanufactures	(1)	2
Other:		
Ores and concentrates	(1)	(1)
Oxides, hydroxides, peroxides of metals	r15	23
NONMETALS		
Abrasives:		
Pumice, emery, natural corundum, etc	70	(1)
Dust and powder of precious and semiprecious stones ... kilograms	3	2
Grinding and polishing wheels and stones	1	1
Cement	97,312	90,546
Chalk	2	--
Clays and clay products:		
Crude:		
Bentonite	25	--
Other	5	18
Products, refractory	3	12
Diamond:		
Gem ... carats	115,550	48,205
Industrial ... do	222,863	89,880
Fertilizer materials, crude and manufactured	r12,907	15,197
Gypsum and plasters	67	2
Lime	180	76
Pigments, mineral:		
Natural, crude	2	1
Iron oxides, processed	--	30
Salt	250	13
Sodium and potassium compounds:		
Caustic soda	127	3
Caustic potash	1	(1)
Stone, sand and gravel	3	1
Sulfur:		
Elemental	160	--
Sulfuric acid	49	175
Talc	21	22
Other, crude	2	30
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	69	(1)
Coal and coke, including briquets	(1)	--
Hydrogen, helium, rare gases	7	2
Petroleum:		
Crude and partly refined ... thousand 42-gallon barrels	(1)	(1)
Refinery products:		
Gasoline ... do	626	675
Kerosine and jet fuel ... do	96	99
Distillate fuel oil ... do	768	733
Residual fuel oil ... do	1,896	1,800
Lubricants ... do	93	96
Liquefied petroleum gas ... do	11	30
Other ... do	1	6
Total ... do	3,491	[illegible]
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	8	3

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[r] Revised.
[1] Less than 1/2 unit.

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Table 3.—Ivory Coast: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum metal including alloys, all forms	9,833	7,413
Chromium oxide and hydroxide	7	11
Copper:		
Matte	8	--
Metal including alloys, all forms	594	1,260
Iron and steel metal:		
Scrap	253	1,850
Sponge iron, powder, shot	70	56
Ferroalloys:		
Ferromanganese	10	25
Other	2	14
Steel, primary forms	10,858	12,728
Semimanufactures	107,788	122,849
Lead:		
Oxides	323	310
Metal including alloys, all forms	272	504
Magnesium metal including alloys, all forms	(1)	(1)
Manganese:		
Ore and concentrate	720	802
Oxides	996	1,270
Mercury 76-pound flasks	18	7
Nickel metal including alloys, all forms	23	4
Platinum-group metals including alloys, all forms troy ounces	162	418
Silver metal including alloys, all forms do	203,450	144,879
Tin:		
Oxides	(1)	1,450
Metal including alloys, all forms	34	22
Titanium:		
Ore and concentrate	11	16
Oxides	285	359
Zinc:		
Oxide	94	22
Metal including alloys, all forms	2,414	3,184
Other:		
Ores and concentrates	^{r}736	(1)
Oxides, hydroxides, peroxides of metals	22	95
Metals including alloys, all forms	1	(1)
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	31	83
Grinding and polishing wheels and stones	^{r}109	109
Asbestos	6	6
Barite	106	3,243
Boron materials: Crude natural borates	451	210
Cement	754,071	1,033,465
Chalk	2,727	3,077
Clays:		
Bentonite	371	403
Kaolin	120	114
Other	212	136
Diamond, all grades carats	--	45,000
Diatomite	375	310
Feldspar	10	10
Fertilizer materials:		
Crude, phosphatic	1,584	7,175
Manufactured	69,514	55,662
Ammonia	3,189	3,451
Gypsum and plasters	44,832	49,451
Kieserite	5,150	5,110
Lime	5,032	6,314
Magnesite	25	18
Pigments, mineral:		
Natural, crude	159	111
Iron oxides, processed	183	86
Salt	30,716	36,267
Sodium and potassium compounds, n.e.s	10,295	9,764
Stone, sand and gravel	^{r}11,203	14,749
Sulfur:		
Elemental, all forms	5,363	5,337
Sulfuric acid	90	49
Talc	879	1,558
Other, crude	11	--
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	69	72
Coal and coke, including briquets	194	199
Hydrogen, helium, rare gases	2	15
Peat	59	85

See footnotes at end of table.

Table 3.—Ivory Coast: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
MINERAL FUELS AND RELATED MATERIALS —Continued		
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	11,234	11,822
Refinery products:		
Gasoline do	82	403
Distillate fuel oil do	175	170
Residual fuel oil do	36	23
Lubricants do	204	347
Bitumen do	174	212
Other do	r73	94
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	760	673

rRevised.
[1]Less than 1/2 unit.

Table 4.—Mali: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
METALS			
Aluminum metal scrap	--	321	Morocco 75.
Iron and steel semimanufactures:			
Bars, rods, angles, shapes, sections	14,699	4,946	France 2,729; U.S.S.R. 1,153; China, mainland, 828.
Universals, plates, sheets	--	4,042	France 2,425; Japan 655; Belgium-Luxembourg 486.
Rails and accessories	2,837	649	Mainly from France.
Wire	938	592	Netherlands 221; France 113.
Tubes, pipes, fittings	1,089	5,421	France 4,429; United Kingdom 711.
Castings and forgings, rough	158	--	
Other nonferrous metals including alloys, unwrought and semimanufactures value, thousands	$389	$215	West Germany $113.
NONMETALS			
Cement	22,126	23,889	Senegal 9,704; Ivory Coast 5,649; China, mainland, 5,520.
Clay products, nonrefractory	371	1,448	France 869; Italy 505.
Fertilizer materials, manufactured:			
Nitrogenous	910	3,500	All from France.
Phosphatic	14,780	6,000	All from Senegal.
Other, including mixed	1,000	12,616	Senegal 12,500.
Salt	23,686	32,608	Senegal 26,976; France 3,623; Algeria 1,619.
Stone, sand and gravel	--	1,436	NA.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline 42-gallon barrels	306,136	363,919	Ivory Coast 298,707; Senegal 28,756; Tri- dad and Tobago 12,861.
Kerosine do	90,621	67,596	Ivory Coast 32,953; Senegal 24,978; Vene- uela 4,712.
Distillate fuel oil do	343,063	336,118	Senegal 146,358; Ivory Coast 140,096; Venezuela 20,784.
Residual fuel oil do	58,082	41,405	Senegal 31,142; Ivory Coast 10,256.
Lubricants do	23,303	18,648	Senegal 8,610; Ivory Coast 4,627; Vene- la 2,702.
Other do	5,243	12,621	U.S.S.R. 5,964; Venezuela 4,459.

NA Not available.

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The Mineral Industry of the Islands of the Caribbean

By Doris M. Hyde[1]

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Limited geographically by size and geologically by origin, smaller countries and territories of the Caribbean are nonetheless engaging in efforts to encourage the initiation of mineral and mineral-related industries. Petroleum dominates the minerals sector, which otherwise consists principally of minor quantities of construction-oriented materials, usually for local consumption. The increased cost of petroleum has adversely affected most of the world, but these islands with their economies precariously balanced on the uncertainties of agriculture and tourism are especially vulnerable to petroleum's direct and indirect costs.

In 1975, the Government of Antigua acquired the financially troubled West Indies Oil Company refinery at St. Johns. The refinery ceased operations in 1976. In 1979, negotiations were underway to sell Ashland Oil Co. an interest in the small, 20,000-barrel-per-day refinery for $6.6 million. In 1977, Antigua granted petroleum exploration rights to the Antigua Mineral Exploration Company, which planned to drill in an undefined offshore area, possibly between Antigua and Barbuda. The company expected to spend about $200,000 per year through 1982. There have been no reports on its activity.

On Little Cayman Island, just south of Cuba, Cayman Energy Ltd. joined with Texas Eastern Corp. to conduct a feasibility study for a shore-based crude oil transshipment terminal. The terminal, with a capacity of more than 1 million barrels per day, would include storage and service facilities.

Santa Lucia's entry into the petroleum transshipment industry was scheduled for late 1979 when the terminal construction at the Hess Oil St. Lucia Ltd. petroleum complex will be completed. The time frame for refinery construction would be determined to some extent by the state of the market. The Government has no shares in the petroleum complex but benefits from taxes on throughtput and the employment of Santa Lucians.

In late 1979, the British Virgin Islands granted a petroleum exploration license to three Canadian firms—Noranda Mines, Ltd., Brenda Mines, Ltd., and Flin Flon Mines, Ltd. The license includes 462,000 acres on the Atlantic side of the islands. Geophysical surveys of the area were underway.

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Table 1.—Islands of the Caribbean: Production of mineral commodities

Area,[1] commodity, and unit of measure	1976	1977	1978[p]	1979[e]
BAHAMAS[2]				
Cement, hydraulic thousand metric tons	271	22	369	360
Petroleum refinery products:[e]				
Jet fuel thousand 42-gallon barrels	7,708	9,935	9,160	9,000
Distillate fuel oil do	8,928	21,452	9,885	9,500
Residual fuel oil do	36,099	53,032	34,565	35,000
Other do	10,791	15,939	11,080	11,000
Refinery fuel and losses do	707	888	900	900
Total do	64,233	101,246	65,590	65,400
Salt thousand metric tons	1,353	1,670	1,633	1,300
Stone:				
Aragonite do	2,069	2,454	3,200	3,500
Limestone for cement do	35	NA	524	500
Sulfur, byproduct of petroleum do	49	60	58	60
BARBADOS[2]				
Gas, natural:				
Gross[e] million cubic feet	158	197	444	450
Marketed do	[e]152	[e]130	152	150
Petroleum:				
Crude thousand 42-gallon barrels	110	124	272	300
Refinery products:				
Gasoline do	311	328	333	350
Kerosine do	71	62	60	60
Distillate fuel oil do	378	229	267	300
Residual fuel oil do	279	518	471	500
Other do	33	30	35	30
Refinery fuel and losses do	126	137	18	40
Total do	1,198	1,304	1,184	1,280
CUBA[2] [3]				
Cement, hydraulic thousand metric tons	2,500	2,657	[e]2,600	2,600
Chromite[e] do	30	30	30	30
Cobalt[e] metric tons	1,600	1,600	1,600	1,700
Copper, mine output, metal content[e] do	[r]2,980	[r]2,600	2,900	2,500
Gas, natural:				
Gross[e]	1,220	[r]1,250	1,400	1,500
Marketed	742	[r]758	834	850
Gypsum thousand metric tons	85	91	95	91
Iron and steel: Crude steel do	[r]296	300	300	270
Nickel:[e]				
Mine output (content of oxide and sulfide) metric tons	[r]36,922	37,000	37,000	37,000
Metal, smelter[4]	[r]18,400	[r]18,500	18,000	18,000
Nitrogen: N content of ammonia[e] thousand metric tons	90	90	90	140
Petroleum:				
Crude thousand 42-gallon barrels	958	[r] [e]665	[e]333	300
Refinery products:				
Motor gasoline do	7,727	[e]8,075	[e]8,075	8,000
Kerosine do	3,528	[e]3,691	[e]3,800	3,700
Distillate fuel oil do	6,984	[e]7,483	[e]7,714	7,500
Residual fuel oil do	20,078	[e]20,919	[e]21,079	21,000
Lubricating oil do	1,155	[e]1,188	[e]1,180	1,200
Other:				
Liquefied petroleum gas[e] do	[r]1,049	1,118	1,130	1,150
Unspecified[e] do	[r]3,290	3,437	2,023	2,100
Total do	43,811	[e]45,911	[e]45,001	44,650
Pyrite, gross weight[e] thousand metric tons	50	50	50	50
Sulfur:				
Content of pyrite[e] do	20	20	20	20
Byproduct of petroleum[e] do	8	8	8	8
Total do	28	28	28	28
DOMINICA				
Stone, sand and gravel: Pumice and volcanic ash do	109	109	109	100
DOMINICAN REPUBLIC[e]				
Aluminum: Bauxite, dry equivalent, gross weight[5] do	517	583	568	570
Cement, hydraulic do	[r]654	862	867	900
Copper, mine output do	--	--	--	3

See footnotes at end of table.

Table 1.—Islands of the Caribbean: Production of mineral commodities —Continued

Area, [1]commodity, and unit of measure	1976	1977	1978[p]	1979[e]
DOMINICAN REPUBLIC[2] —Continued				
Gypsum:				
For cement thousand metric tons	[r]218	224	170	89
Other do	[r]2	2	[e]2	2
Gold thousand troy ounces	414	348	336	333
Iron and steel ferroalloys: Ferronickel metric tons	68,187	71,332	37,612	50,000
Lime do	[r]17,608	22,047	[e]21,000	21,000
Mercury 76-pound flasks	--	495	500	500
Nickel:				
Mine output, metal content metric tons	24,400	24,900	14,300	25,054
Metal, smelter (Ni content of ferronickel shipments) do	24,400	24,900	14,300	25,054
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	2,728	2,738	2,814	2,500
Kerosine and jet fuel do	375	353	425	400
Distillate fuel oil do	2,523	2,665	2,690	2,500
Residual fuel oil do	4,368	2,643	2,830	2,600
Other do	1,691	613	730	600
Refinery fuel and losses do	489	423	272	250
Total do	12,174	9,435	9,761	8,850
Salt metric tons	38,745	68,278	36,073	36,000
Silver metal thousand troy ounces	907	1,357	1,848	1,900
Stone, sand and gravel:				
Limestone thousand metric tons	[r]272	302	[e]300	300
Sand and gravel do	[r]1,165	1,228	[e]1,200	1,200
GUADELOUPE				
Abrasives, natural: Pumice do	200	190	200	200
Cement do	136	136	[e]136	136
Stone:				
Crushed and broken do	NA	761	[e]700	700
Limestone do	NA	793	NA	700
HAITI[3]				
Aluminum: Bauxite, dry equivalent, gross weight do	660	588	580	530
Cement, hydraulic do	[r]230	266	249	270
Clays do	64	67	60	65
Gypsum for cement metric tons	NA	10,353	[e]10,000	10,000
JAMAICA				
Aluminum:				
Bauxite, dry equivalent, gross weight thousand metric tons	[r]10,312	11,433	11,736	11,574
Alumina do	1,621	2,036	2,142	2,074
Cement, hydraulic do	365	333	265	272
Clays for cement do	132	160	99	[e]99
Gypsum metric tons	253,194	214,824	130,312	--
Lime do	[e]244	186	152	154
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	1,189	1,879	1,998	1,745
Kerosine do	482	349	349	379
Jet fuel do	481	480	560	847
Distillate fuel oil do	1,831	1,858	1,977	1,954
Residual fuel oil do	3,789	2,391	2,498	4,164
Other:				
Liquefied petroleum gas do	281	255	233	413
Unspecified do	212	140	301	99
Refinery fuel and losses do	243	1,504	1,170	321
Total do	8,508	8,856	9,086	9,922
Sand and gravel:				
Glass sand thousand metric tons	26	17	14	[e]11
Common sand and gravel do	3,479	812	500	[e]1,370
Stone:				
Limestone do	868	717	614	[e]870
Other do	1	[e]914	1,128	[e]8,200
MARTINIQUE				
Clays thousand cubic meters	[e]27	27	38	35
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	NA	1,149	1,176	[e]1,260
Kerosine do	NA	177	126	[e]121
Jet fuel do	NA	798	893	[e]706
Distillate fuel oil do	NA	454	561	[e]581
Residual fuel oil do	NA	935	990	[e]1,093
Liquefied petroleum gas do	NA	NA	242	[e]241
Total do	NA	NA	3,988	[e]4,011

See footnotes at end of table.

Table 1.—Islands of the Caribbean: Production of mineral commodities —Continued

Area,[1] commodity, and unit of measure	1976	1977	1978[p]	1979[e]
MARTINIQUE —Continued				
Pumice ---- thousand metric tons	[e]80	287	[e]280	310
Stone, sand and gravel:				
Stone, crushed and broken ---- thousand cubic meters	[e]300	349	471	[e]397
Sand ---- do	[e]250	261	149	[e]228
MONTSERRAT				
Sand and gravel, natural ---- cubic meters	5,402	3,161	12,300	13,000
Other quarry products[7] ---- do	8,103	3,393	[e]3,300	3,000
NETHERLANDS ANTILLES[8]				
Petroleum refinery products:				
Gasoline:				
Aviation ---- thousand 42-gallon barrels	1,276	1,202	1,530	1,800
Motor ---- do	15,120	17,223	18,172	19,000
Jet fuel ---- do	16,316	12,908	15,317	16,000
Kerosine ---- do	5,906	353	432	500
Distillate fuel oil ---- do	21,635	24,660	28,055	29,000
Residual fuel oil ---- do	119,283	100,265	110,996	115,000
Lubricants ---- do	4,221	3,355	3,355	3,400
Other ---- do	28,948	25,280	26,961	27,000
Refinery fuel and losses ---- do	13,264	12,264	9,928	10,000
Total ---- do	225,969	197,510	214,746	221,500
Nitrogen: N content of ammonia ---- thousand metric tons	84,076	33,846	--	--
Phosphate rock ---- do	54	79	81	90
Salt[e] ---- do	480	400	400	400
Sulfur, byproduct of petroleum ---- do	95	94	95	95
ST. VINCENT				
Salt ---- do	50	50	50	50
Sand and gravel, natural ---- thousand cubic meters	413	413	[e]410	400
Other quarry products ---- do	764	764	[e]760	730
TRINIDAD AND TOBAGO				
Asphalt, natural ---- thousand metric tons	66	44	64	65
Cement, hydraulic ---- do	242	216	220	[e]216
Clays:				
Argillite ---- thousand cubic meters	68	121	[e]130	130
Other ---- do	(8)	89	[e]90	90
Gas, natural:				
Gross ---- million cubic feet	137,959	150,000	157,919	160,000
Marketed ---- do	78,558	81,200	[e]154,000	157,000
Gypsum ---- metric tons	--	(8)	--	--
Natural gas liquids ---- thousand 42-gallon barrels	53	[e]50	[e]50	50
Nitrogen: N content of ammonia ---- metric tons	162,870	176,454	400,772	[e]388,654
Petroleum:				
Crude ---- thousand 42-gallon barrels	77,673	83,950	83,773	75,000
Refinery products:				
Gasoline:				
Aviation ---- do	319	361	354	300
Other ---- do	10,187	18,355	16,795	17,000
Jet fuel ---- do	4,281	2,462	2,219	2,200
Kerosine ---- do	6,864	5,802	4,501	5,000
Distillate fuel oil ---- do	12,161	10,705	10,134	10,200
Residual fuel oil ---- do	67,797	56,296	45,478	50,000
Lubricants ---- do	824	926	725	800
Other:				
Liquefied petroleum gas ---- do	404	465	610	600
Asphalt ---- do	130	201	173	200
Unspecified ---- do	11,331	3,415	2,045	2,500
Refinery fuel and losses ---- do	3,297	3,010	2,848	3,000
Total ---- do	117,595	101,998	85,882	91,800
Sand and gravel:				
Pitch sand ---- thousand cubic meters	207	46	[e]45	46
Other sand and gravel ---- do	360	642	[e]500	550
Stone:				
Diorite ---- do	1	1,153	[e]1,000	1,000
Limestone:				
For cement ---- thousand metric tons	395	323	[e]350	330
Other ---- thousand cubic meters	NA	445	[e]450	450
Porcelanite ---- do	27	[e]27	[e]27	27

See footnotes at end of table.

Table 1.—Islands of the Caribbean: Production of mineral commodities —Continued

Area, [1]commodity, and unit of measure	1976	1977	1978[p]	1979[e]
TRINIDAD AND TOBAGO —Continued				
Sulfur, byproduct of petroleum[10] ---- thousand metric tons	55	30	54	55

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the countries listed, Bermuda, Grenada, and St. Lucia presumably produced crude construction materials (clays, sand and gravel, and stone), but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] In addition to the commodities listed, other crude construction materials (lime, salt, and sand and gravel) may also be produced, but data on such production are not collected and available information is inadequate to make reliable estimates of output levels.

[3] In addition to the commodities listed, iron ore, manganese ore, and salt, all produced in significant quantities prior to the termination of publication of official statistics, presumably were produced during the period covered by this table, but available information is inadequate to make reliable estimates of output levels.

[4] Includes Ni content of nickel oxide and nickel fonte in addition to metallic nickel and ferronickel.

[5] Data represent exports; all production is presumed to be exported.

[6] Reported figure.

[7] Includes crushed volcanic rock, limestone, diorite, and quartzite used for building stone, aggregate, road construction, etc.

[8] Less than 1/2 unit.

[9] Revised to none.

[10] Limited quantities of sulfur as a byproduct of natural gas may also be produced.

BAHAMAS

New petroleum legislation was enacted during 1978, amending the Petroleum Act of 1971. Passage of the Petroleum Amendment Act of 1978 was followed by the publication of appropriate regulations in the Bahamas' Official Gazette, Supplement Part II, September 7, 1978. These extensive regulations detail the terms under which the Government will award permits, licenses, and leases for petroleum exploration and exploitation.

No applications for petroleum permits or licenses were initiated in 1978 or 1979 as companies awaited the issuance of official guidelines and the designation of specific areas to be open for exploration.

In 1978, the financial problems of the Grand Bahama Petroleum Co. (PETCO), a subsidiary of the U.S. based Carey Energy Corp., culminated in an unfavorable Bahamas Supreme Court decision on PETCO's outstanding trade credit debt dispute with the National Oil Co. of Libya. Unable to comply with the Court's order to pay the estimated $158 million owed to Libya, and with total debts thought to approach $500 million, PETCO was forced into liquidation proceedings. PETCO held a 65% interest in the Bahamas Oil Refining Co. (BORCO), and Standard Oil Co. of California owned the remaining 35% interest. Subsequently, as discussed below, the percent interest in BORCO was changed.

In May 1979, a U.S. firm, Charter Co., purchased Carey Energy Corp. and thus acquired ownership of PETCO and its interest in BORCO. After a series of negotiations with PETCO's creditors and ownership challenges through the Bahamian court liquidators by a Venezuelan company, Hideca Trading Corporation (which wished to purchase PETCO), Charter finally established ownership.

Part of Charter's negotiations to satisfy Standard Oil Co. of California for its outstanding $103 million loan to PETCO, involved transfering 15% of PETCO's interest in BORCO to Standard Oil, giving both companies a 50% interest in the refinery. The somewhat complicated relationships between Carey Energy and its subsidiaries and Charter's purchase of Carey Energy were covered by newspaper reports.[3]

In 1978, Burmah Oil Ltd. and the Government reached an agreement on the renegotiation of Burmah's management contract for the operation of the Grand Bahama Oil Transshipment Terminal. The new agreement guarantees the Government a minimum annual payment, starting in 1979, of $1.8 million plus an additional 1.8 cents per barrel on throughput in excess of 100 million barrels and 3 cents per barrel for amounts over 150 million barrels. Burmah also agreed to assume responsibility for all outstanding debts the Government incurred in constructing the terminal. Aside from its 1972-1992 management contract, Burmah has no holding in the terminal.

In January 1978, United States Steel

Corp. sold its 100% interest in the 520,000-ton-per-year capacity Bahama Cement Company to International Development Corp. S.A. of Luxembourg. Plant operation resumed shortly thereafter and cement again became an important mineral-related export.

BARBADOS

Even though Barbados produces crude oil and natural gas, it cannot provide for its growing domestic needs. In 1979, national gross commercial energy consumption was estimated at approximately 6,000 barrels per day, an amount conservatively predicted to double by 1985. In response to the economic strains posed by increasing prices for imported petroleum, in 1979 the Government announced the establishment of an Energy and Natural Resource Division within the Ministry of Trade and Industry. Increased exploration, improved operating procedures for existing wells, and an attempt to control the growth of petroleum energy demand, possibly through the use of alternative forms of energy, were options under consideration by the new agency to decelerate the prospect of increased oil imports.

In 1979, General Crude Oil Co., whose control of Barbados' oil exploration and exploitation operations have been the object of criticism for reduced production capability, sold its operations to Mobile Oil Barbados Ltd. Mobile also operates the small local refinery. In 1979 the Government allowed price increases for petroleum products to more realistically reflect crude oil import costs.

Proven petroleum reserves were estimated at 2 million barrels of oil and 2.5 billion cubic feet of natural gas. Preliminary evaluations of exploration work indicated that at least 10 onshore fields exist which are geologically similar to the now-producing Woodbourne field, and offshore prospects have also been encouraging. It was estimated that Barbados may have reserves of 15 million barrels of oil. A seismic survey was begun in late 1979. Based on the results of this survey, a more detailed survey and production study may be undertaken. The Government was reported to be interested in a joint partnership arrangement whereby contributions to its share of drilling costs would come out of royalties only if commercial quantities of oil were discovered.

Nonfuel mineral production was limited to construction-oriented materials, mostly for domestic consumption. The new cement plant, jointly owned by the Governments of Barbados and Guyana, was scheduled to become operational by the end of 1979. Barbados and the Government of Trinidad and Tobago have agreed to jointly establish a cement plant in Barbados. Trinidad and Tobago will provide fuel and financal assistance to the project.

Table 2.—Barbados: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976[1]	1977
METALS		
Aluminum metal including alloys:		
Scrap	NA	7
Unwrought and semimanufactures	NA	[illegible]
Copper metal including alloys:		
Scrap	NA	[illegible]
Unwrought and semimanufactures	NA	[illegible]
Iron and steel metal:		
Scrap	NA	[illegible]
Pig iron, ferroalloys, similiar materials value	NA	[illegible]
Semimanufactures	13	[illegible]
Lead metal including alloys, scrap	NA	[illegible]
Zinc metal including alloys, unwrought and semimanufactures kilograms	NA	[illegible]
NONMETALS		
Barite and witherite value	NA	[illegible]
Cement	NA	1
Clays and clay products (including all refractory brick):		
Crude	NA	[illegible]
Products:		
Refractory (including nonclay brick)	NA	[illegible]
Nonrefractory	NA	[illegible]

See footnotes at end of table.

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Table 2.—Barbados: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity		1976[1]	1977[2]
NONMETALS —Continued			
Fertilizer materials:			
Manufactured	value	NA	$1,469
Ammonia	kilograms	NA	376
Gypsum and plasters		NA	1
Lime		NA	74
Salt		NA	1
Stone, sand and gravel:			
Dimension stone:			
Crude	kilograms	NA	254
Worked		NA	8
Gravel and crushed rock		NA	235
Sand, excluding metal bearing	value	NA	$40
Sulfuric acid		NA	1
Other, crude	kilograms	NA	36
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades, excluding briquets[4]		NA	1
Hydrogen, helium, rare gases	kilograms	NA	132
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	22	NA
Refinery products:[4]			
Gasoline	do.	NA	3
Kerosine	do.	[5]126	NA
Jet fuel	do.	([5])	308
Distillate fuel oil	do.	290	261
Residual fuel oil	do.	389	227
Lubricants	do.	2	3
Other:			
Liquefied petroleum gas	do.	NA	([6])
Mineral jelly and wax	do.	NA	([6])
Unspecified	do.	NA	([6])
Total	do.	807	802
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	kilograms	NA	204

NA Not available.

[1] United Nations. Commodity Trade Statistics 1976. Statistical Papers, ser. D, v. 26, Nos. 1-16.

[2] Official trade statistics of Barbados.

[3] Partial figure; excludes glazed and unglazed ceramic tiles valued at $78,729.

[4] Includes bunkers.

[5] Kerosine and jet fuel are inseparable in source.

[6] Less than 1/2 unit.

Table 3.—Barbados: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1976[1]	1977[2]
METALS			
Aluminum:			
Oxide and hydroxide		NA	1
Metal including alloys, all forms		585	559
Copper metal including alloys, all forms		26	52
Iron and steel metal:			
Scrap		NA	53
Pig iron, ferroalloys, similar materials		NA	341
Steel, primary forms		NA	27
Semimanufactures		3,308	11,236
Lead metal including alloys:			
Scrap		NA	10
Unwrought and semimanufactures		NA	44
Nickel metal including alloys:			
Scrap		NA	1
Unwrought and semimanufactures		NA	2
Platinum-group metals including alloys	troy ounces	NA	170
Silver metal including alloys	do.	NA	4,872
Tin metal including alloys, all forms		NA	11
Zinc metal including alloys:			
Scrap		NA	5
Unwrought and semimanufactures		NA	1

See footnotes at end of table.

Table 3.—Barbados: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976[1]	1977[2]
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	NA	2
Grinding and polishing wheels and stones	NA	2
Asbestos	NA	7
Barite and witherite	NA	99
Cement	35,475	43,462
Chalk	NA	49
Clays and clay products (including all refractory brick):		
Crude	NA	16
Products:		
Refractory (including nonclay brick)	NA	171
Nonrefractory	NA	[3]17
Diamond, gem, not set or strung ... carats	NA	1,076
Diatomite and other infusorial earth	NA	50
Fertilizer materials:		
Manufactured:		
Nitrogenous	1,659	2,299
Phosphatic	NA	6
Potassic	NA	866
Other, including mixed	9,942	5,932
Ammonia	NA	14
Graphite, natural ... kilograms	NA	77
Gypsum and plasters	NA	87
Lime	NA	281
Magnesite ... value	NA	834
Mica, all forms	NA	23
Pigments, mineral	NA	5
Precious and semiprecious stones, except diamond, natural ... carats	NA	699
Salt	NA	2,222
Sodium and potassium compounds, n.e.s	NA	181
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	NA	24
Worked	NA	94
Dolomite, chiefly refractory grade	NA	1
Gravel and crushed rock	NA	257
Limestone (except dimension)	NA	2
Quartz and quartzite	NA	1
Sand, excluding metal bearing	NA	118
Sulfur:		
Sulfur dioxide ... kilograms	NA	130
Sulfuric acid, including oleum	NA	101
Talc, steatite, soapstone, pyrophyllite	NA	29
Other:		
Crude	NA	48
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	NA	434
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	NA	33
Coal, all grades, including briquets	NA	99
Coke and semicoke	NA	64
Hydrogen, helium, rare gases	NA	4
Peat, including peat briquets and litter	NA	15
Petroleum:		
Crude and partly refined ... thousand 42-gallon barrels	751	924
Refinery products:		
Gasoline ... do	154	146
Kerosine ... do	[4]459	7
Jet fuel ... do	([4])	521
Distillate fuel oil ... do	249	284
Residual fuel oil ... do	201	331
Lubricants ... do	14	16
Other:		
Liquefied petroleum gas ... do	87	[illegible]
Unspecified ... do	NA	1
Total ... do	1,164	1,378
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	NA	45

NA Not available.

[1] United Nations. Commodity Trade Statistics 1976. Statistical Papers, ser. D, v. 26, Nos. 1-16.

[2] Official trade statistics of Barbados.

[3] Partial figure; excludes glazed and unglazed ceramic tiles valued at $1,081,491.

[4] Kerosine and jet fuel are inseparable in source.

BERMUDA

Mining activity remained limited to minor quantities of sand, dimension stone and crushed limestone, all for domestic consumption. There have been no reports of interest in petroleum exploration in this area.

Table 4.—Bermuda: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations/sources, 1977
EXPORTS			
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products (all bunker loadings):[1]			
Gasoline:			
Aviation __ thousand 42-gallon barrels__	614	763	Bermuda 425; Jamaica 338.
Motor __ do__	314	411	Bermuda 241; Jamaica 170.
Jet fuel __ do__	11	11	Jamaica 6; Bermuda 5.
Distillate fuel oil __ do__	111,756	276	Bermuda 147; Aruba and Curaçao 88.
Total __ do__	112,695	1,461	
IMPORTS			
METALS			
Aluminum metal including alloys, all forms	14	13	United States 6; United Kingdom 5.
Copper metal including alloys, all forms	8	5	United States 4.
Iron and steel metal:			
Pig iron, sponge iron, ferroalloys	--	29	All from United Kingdom.
Steel, primary forms __ thousand tons__	10	7	United States 5; United Kingdom 2.
Blooms, billets, slabs, sheet, bars	815	--	
Semimanufactures:			
Universals, plates, and sheets, uncoated thousand tons__	4	12	United Kingdom 11.
Castings and forgings, unworked	289	133	United States 125.
Lead metal including alloys, all forms	(2)	20	United Kingdom 18; United States 2.
Nickel metal including alloys, all forms	2	(2)	NA.
Platinum-group and silver metals including alloys:			
Platinum-group __ troy ounces__	15	32	All from United Kingdom.
Silver __ do__	2,349	487	United States 363; United Kingdom 85; West Germany 32.
Tin metal including alloys, all forms	(2)	--	
Zinc metal including alloys, all forms	(2)	3	United States 2; United Kingdom 1.
Other, nonferrous	(2)	(2)	NA.
NONMETALS			
Abrasives, natural: Grinding and polishing wheels and stones	15	(2)	NA.
Cement	9,830	11,177	Mexico 7,741; Bahamas 3,388.
Clays and clay products:			
Clays and other refractory materials	58	97	United States 85; United Kingdom 11.
Clay brick	708	752	Malaysia 291; United Kingdom 276; France 132.
Diamond, not set or strung __ carats__	1,361	312	United States 246.
Fertilizer materials:			
Crude	49	43	United States 42.
Manufactured:			
Nitrogenous	13	30	All from United States.
Phosphatic	1	6	Do.
Potassic	15	--	
Mixed	745	687	United States 425; United Kingdom 161.
Gypsum and plasters	406	282	United States 271.
Lime	284	483	United States 381; Canada 68; United Kingdom 33.
Precious and semiprecious stones, except diamond:			
Natural __ value[3]__	$816	$46,774	United Kingdom $39,743; United States $5,638.
Manufactured __ do__	$210	$1,354	United States $1,350.
Stone, sand and gravel:			
Dimension stone	436	94	United States 45; United Kingdom 32; Portugal 7.
Gravel and crushed stone	25,438	13,752	United States 13,751.
Sand	2,748	208	All from United States.

See footnotes at end of table.

Table 4.—Bermuda: Foreign trade in selected mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations/sources, 1977
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets	102	21	All from United States.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	330	335	Aruba and Curaçao 334.
Kerosine do	319	3	Aruba and Curaçao 3.
Distillate fuel oil do	1,925	1,721	Aruba and Curaçao 841; Venezuela 697.
Lubricants do	735	348	Jamaica 338.
Other:			
Greases do	(2)	(2)	NA.
Bitumen do	(2)	(2)	NA.
Bunker fuel oil do	1,255	996	Venezuela 892; Aruba and Curaçao 21.
Total do	4,564	3,403	

NA Not available.

[1] Bunkers originating with the British NATO and the U.S. Armed Forces.

[2] Less than 1/2 unit.

[3] Value is reported in British currency.

CUBA

The mineral industries account for an estimated 7% of Cuba's total exports. On an international level, the only significant minerals are nickel and cobalt. Cuba has ranked fifth in world nickel production for the last 6 years. Expansion projects now underway or planned could eventually place Cuba as the second largest world producer of nickel.

Declining productivity and inefficient management have been the subjects of considerable internal criticism and were blamed for the Government's failing to meet some economic development objectives. Late in 1979, as Cuba entered the final year of its first 5-year plan (1976-1980), the Government promised legislation to strengthen efficient management practices and to provide material incentives to encourage productivity.

In recent years, Cuba's opportunities to expand trade and cooperation agreements have improved but hard currency for payments remains a problem. Cuba favors trade and industrial development compensation agreements in which at least partial payment can be made by domestic products.

Cuba remained unaffected by the continued depression in the world nickel industry during 1978. Nickel sales prices had been favorably established at $2.72 per pound of nickel through contracts with member countries of the Council for Mutual Economic Assistance (CMEA).[3] About two-thirds of Cuba's nickel production is exported to CMEA countries while the remainder is sold on the free world market. Cuba, with operating costs estimated at $1.20 to $1.90 per pound, was able to show some gain in hard currency.

Cuba's oil import costs have increased substantially. Oil imports from the Soviet Union in 1978 were placed at about 200,000 barrels per day at an estimated annual cost of $711 million, well above the $507 million value of 1977 oil imports. Fuel conservation and alternative energy sources are areas of immediate concern. Oil supplies are assured by the U.S.S.R. until 1985 at prices considerably less than those on the world market.

The construction of a nuclear power station near Cienfuegos appeared to be stalled. The first site choice was discarded when geological evidence proved the area unsuitable. A second site, not too distant from the first, was selected but evidently questions regarding plant safety standards, and possibly geological considerations, have arisen. At the end of 1979, the Government announced a 2-year delay in construction.

COMMODITY REVIEW

An economic and technical cooperation meeting of CMEA members was held early in 1978 during which it was generally agreed to intensify the development of Cuba's mineral industries, particularly copper, lead, zinc, and phosphate rock. Corroborating this interst in minerals industry diversification was Cuba's request for a loan from the Belgium Government, partly to be used in the construction of a nonferrous plant to produce lead, zinc, and pyrite concentrates. The nonferrous plant project included the participation of an unnamed Belgian company.

Metals.—*Iron and Steel.*—Negotiations continued with French, Spanish, and Belgian concerns regarding participation in the construction of a 50,000-60,000 tons per year stainless steelworks in Oriente Province. A portion of the $500 million plant construction costs would be paid through shipments of stainless steel to the European firms. The expansion of the José Marti steelworks continued, and production capacity was expected to reach 450,000 tons per year by 1980 and 600,000 tons per year by 1985. There were reports that planners now envision a 2.6-million-ton-per-year capacity by 1990, although details were not made available.

Nickel.—The second phase of Cuba's nickel expansion program was underway in 1979. The new Punta Gorda smelter, east of the Moa smelter, was expected to be onstream in 1981. Another new plant, scheduled for completion in 1985, will be built at Las Camariocas. Czechoslovakian enterprises have contracted to supply a 24-megawatt thermal power station, a compressor station, pipeline system, and a cooling system for the Las Camariocas plant.

A study of the laterite nickel deposits near Moa and Nicaro has been completed. These deposits have been chosen to supply ore to the Camariocas complex. About half of the anticipated new nickel production is projected for CMEA trading partners, the remainder may be destined for Cuba's expanded trade on the world market. Cuba has entered into an agreement with a French firm to use nickel as partial payment for the construction of a paper mill.

Nonmetals.—*Cement.*—VEB Zementanlagembau Dessau was reported to be constructing a large, 1.6-million-ton-per-year cement plant at Cienfuegos. Upon completion of this plant, Cuba's cement capacity will exceed 4 million tons per year. Although cement production has not been sufficient to satisfy domestic needs, Cuba was reported to have made significant exports; some went to Jamaica in 1978 and to both Jamaica and Honduras in 1979. The premature export of cement may have been at least partially motivated by hard currency shortages.

Mineral Fuels.—*Petroleum and Natural Gas.*—Trade journals continued to estimate Cuba's oil production between 1,000 and 5,000 barrels per day, a range which may be interpreted as indicative of the paucity of factual information available. A recent publication on world energy supplies shows a steady decline in Cuban crude oil production and indicated volumes on the low side of most other estimates.[4] For 1978, production was estimated at slightly over 900 barrels per day. The lack of significant discoveries in 1979 would imply a continuing production decline.

Offshore exploration has not yet taken place, although it was discussed during the March 1978 economic and technical cooperation meeting held by CMEA members in Havana. It has been reported that Cuba may be interested in seeking foreign participation for petroleum exploration activities, particularly offshore. No negotiations have been made public.

In 1978, it was reported that a quadrilateral oil exchange had been arranged whereby U.S.S.R. oil supplies for Cuba would be diverted to Spain, while Venezuelan oil intended for Spain would be diverted to Cuba. Such an exchange would not only result in a reduction of freight charges but would increase the availability of tankers for other deliveries.

Table 5.—Cuba: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977[2]	1978[3]	Principal destinations, 1978
METALS			
Aluminum metal including alloys:			
Scrap	190	389	Netherlands 362.
Unwrought	--	672	All to Netherlands.
Chromium: Chromite	28,673	28,937	Mexico 11,500; Poland 9,812; Czechoslovakia 5,000.
Copper:			
Ore and concentrate	2,500	3,482	West Germany 2,000; Finland 1,482.[4]
Metal including alloys:			
Scrap	742	479	Netherlands 275; Belgium-Luxembourg 133.[4]
Semimanufactures	--	[4]21	All to Italy.
Iron and steel metal:			
Scrap	--	96	Austria 59; Japan 37.
Ferroalloys	40	52	All to Austria.
Semimanufactures: Wire	--	30	All to Jamaica.
Lead metal including alloys:			
Scrap	--	[4]55	All to Netherlands.
Unwrought	--	[4]2	All to Spain.
Nickel:			
Ore and concentrate	32	--	
Matte and speiss	3,717	10,876	Netherlands 3,058; Italy 2,757; West Germany 2,329.
Metal including alloys:			
Scrap	24	124	West Germany 76; Belgium-Luxembourg 48.[4]
Unwrought	4,403	2,217	Spain 1,793; Belgium-Luxembourg 405.
Silver metal, unworked or partly worked value, thousands	$1,263	$371	All to Switzerland.
Zinc metal including alloys, scrap	308	[4]69	United Kingdom 44; Netherlands 25.
Other:			
Ores and concentrates	--	4,882	All to Hungary.
Ash and residue, nonferrous	302	489	Norway 232; [4]Netherlands 222.
Oxides, hydroxides, peroxides	2,013	3,894	Italy 3,030; Netherlands 372.
NONMETALS			
Cement	NA	450	All to Jamaica.
Clay products, refractory	NA	202	Do.
Diamond, gem, not set or strung value, thousands	$173	--	
Fertilizer materials, manufactured, potassic	2,195	--	
Precious and semiprecious stones, except diamond value, thousands	--	[4]$35	All to Spain.
Stone, dimension	--	[4]30	All to Italy.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	1,625	2,459	West Germany 1,224; Belgium-Luxembourg 561.
Residual fuel oil do	48	--	
Lubricating oils do	301	--	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	NA	[4]11,556	All to Spain.

NA Not available.

[1] Owing to the lack of official trade data published by Cuba, this table should not be taken as a complete presentation of Cuba's mineral trade. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

[2] 1977 edition of the United Nations Supplement to the World Trade Annual, v. II, as well as trade statistics of Czechoslovakia, Poland, and the U.S.S.R.

[3] Unless otherwise specified, data are compiled from trade statistics of individual trading partners.

[4] 1978 edition of the World Trade Annual, Statistical Office of the United Nations, Walker and Co., New York, 1980.

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Table 6.—Cuba: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977[2]	1978[3]	Principal sources, 1978
METALS			
Aluminum:			
Bauxite	--	175	All from Italy.
Alumina	50	21	France 8;[4] West Germany 8; France 8[3]; Japan 4.
Metal including alloys:			
Unwrought	1,698	1,291	Hungary 1,200.
Semimanufactures	7,306	2,292	Belgium-Luxembourg 1,122;[4] Spain 1,028.
Antimony metal and regulus	--	33	All from Japan.
Cobalt:			
Oxide and hydroxide kilograms	NA	646	Japan 600; Spain 46.
Metal including alloys, all forms do	--	2,000	All from West Germany.
Copper:			
Copper sulfate	--	100	All from Yugoslavia.
Metal including alloys:			
Unwrought	30	20	All from Japan.
Semimanufactures	1,938	1,568	Japan 1,103; Italy 287.[4]
Iron and steel metal:			
Scrap	73,327	83,699	All from U.S.S.R.
Ferroalloys	606	1,102	West Germany 985.
Semimanufactures:			
Bars, rods, angles, shapes, sections	14,002	25,766	Poland 8,495; Hungary 7,562; West Germany 4,551.
Plates and sheets	33,392	17,597	Japan 5,455; France 4,169; Hungary 3,909.
Hoop and strip	1,690	107	All from West Germany.
Rails and accessories	8,277	[4]492	France 388.
Wire	3,408	4,151	Belgium-Luxembourg 3,439;[4] West Germany 607.
Tubes, pipes, fittings	24,718	7,593	Japan 4,001; West Germany 2,176.
Castings and forgings	884	960	Japan 419; Italy 300.[4]
Unspecified[5] thousand tons	737	779	NA.
Lead:			
Oxide	47	1,031	All from France.
Metal including alloys:			
Unwrought	--	1,003	Japan 1,000.
Semimanufactures	413	229	Belgium-Luxembourg 163;[4] West Germany 60.
Manganese:			
Ore and concentrate	--	[4]2	All from Netherlands.
Oxide	238	667	Japan 561.
Nickel metal including alloys, semimanufactures	5	6	Japan 5.
Silver metal, unworked or partly worked value, thousands	$528	--	
Tin metal including alloys, all forms	25	7	Denmark 6[4].
Titanium oxide	--	72	All from West Germany.
Tungsten metal including alloys, all forms kilograms	--	10	All from Japan.
Zinc:			
Oxide	--	1,324	All from United Kingdom.
Metal including alloys:			
Unwrought	607	55	Belgium-Luxembourg 49.[4]
Semimanufactures	--	29	Japan 25.
Other:			
Oxides, hydroxides, peroxides	--	71	West Germany 64.
Metals:			
Metalloids	--	181	France 179.[4]
Base metal, all forms, n.e.s	1	[4]41	Japan 33.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum	--	[4]15	All from Italy.
Grinding and polishing stones	--	91	Spain 80.
Asbestos	--	3,651	Canada 3,508.
Cement thousand tons	122	[5]90	Mainly from U.S.S.R.
Clays and clay products:			
Crude	410	2,091	Spain 1,029; Mexico 509; United Kingdom 470.[4]
Products:			
Refractory	34,978	38,625	U.S.S.R. 31,849; Spain 5,049.[4]
Nonrefractory	36	65	All from Italy.
Diatomite and other infusorial earth	--	252	Italy 176;[4] Japan 76.
Feldspar and fluorspar	--	569	France 377;[4] Japan 100.
Fertilizer materials:			
Crude, phosphatic	NA	15,000	All from Morocco.
Manufactured:			
Nitrogenous	545,205	568,856	U.S.S.R. 568,846.
Phosphatic	244,306	266,373	All from U.S.S.R.
Potassic	136,067	185,025	U.S.S.R. 185,016.
Other, including mixed	3,000	--	

See footnotes at end of table.

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Table 6.—Cuba: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977[2]	1978[3]	Principal sources, 1978
NONMETALS —Continued			
Graphite, natural	--	5	All from Japan.
Gypsum and plasters	--	111	All from West Germany.
Lime	--	[4]14	All from Japan.
Magnesite	1,652	179	Yugoslavia 100; Austria 79.
Mica, all forms	--	[4]192	France 171.
Pigments, mineral: Iron oxides, processed	--	226	Spain 137; West Germany 89.
Precious and semiprecious stones value, thousands	--	[4]$41	Switzerland $31.
Salt	--	[4]3	All from United Kingdom.
Sodium and potassium compounds:			
Caustic soda[5]	35,000	31,800	NA.
Caustic potash	--	83	Japan 81.
Soda ash	15,690	12,609	Bulgaria 12,605.
Stone sand and gravel:			
Dimension stone, worked	NA	12	All from Jamaica.
Quartz and quartzite	--	[4]2	All from West Germany.
Sand	--	[4]143	All from Belgium-Luxembourg.
Sulfur:			
Elemental[5] thousand tons	155	139	NA.
Sulfuric acid	--	17	West Germany 9;[4] Japan 6.
Talc	--	265	Austria 172; Belgium-Luxembourg 60.[4]
Other:			
Crude	--	[4]3	United Kingdom 2.
Oxides of magnesium, strontium, barium	--	8	Japan 6.
Halogens	--	3	All from Japan.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	19	Do.
Carbon black	2,613	161	West Germany 160.[4]
Coal, anthracite and bituminous[5] thousand tons	89	91	NA.
Coke[5] do	--	49	NA.
Petroleum:			
Crude[5] thousand 42-gallon barrels	45,268	46,421	NA.
Refinery products:			
Gasoline[5] do	1,275	1,785	NA.
Distillate fuel oil[5] do	7,438	5,603	NA.
Residual fuel oil[5] do	11,982	14,646	NA.
Lubricants[5] do	679	812	NA.
Other do	1	13	Mainly from Spain.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	321	[4]369	United Kingdom 368.

NA Not available.

[1] Owing to the lack of official trade data published by Cuba, this table should not be taken as a complete presentation of Cuba's mineral trade. These data have been compiled from various sources which include United Nations informatio and data published by the trading partners.

[2] 1977 edition of the United Nations Supplement to the World Trade Annual, v. II, as well as trade statistics of Bulgaria, Czechoslovakia, Hungary, Poland, and the U.S.S.R.

[3] Unless otherwise specified, data are compiled from trade statistics of individual trading partners.

[4] 1978 edition of the World Trade Annual, Statistical Office of the United Nations, Walker and Co., New York, 1980.

[5] Statistical Yearbook of Member States of the Council for Mutual Economic Assistance, Moscow, 1980.

DOMINICAN REPUBLIC

Overall real economic growth continued a slow downward trend, from 6.4% in 1976 to 4.4% in 1977 and 2.3% in 1978. The real growth was estimated at 5.3% in 1979 in spite of the effects of two devastating storms. In 1978, the mining sector accounted for 4.4% of the gross domestic product.

In 1978, total exports were valued at $675.5 million. The three major minerals, bauxite ($23.4 million), nickel ($71.1 million), and gold and silver ($76.2 million), accounting for almost 25% of this amount. In 1979, the value of total exports increased to an estimated $775 million, mostly due to the performance of the mining sector which was not adversely affected by the hurricanes. The three major minerals, bauxite ($20.7 million), nickel ($128.5 million), and gold and silver ($145.3 million), accounted for 38% of total exports in 1979.

In 1978, petroleum and petroleum products accounted for 23% of the $859.2 million of total imports. In 1979, it was estimated that total imports reached $1,070 million, with petroleum responsible for 29% of this amount.

Foreign investors have shown some reluctance to make firm commitments in the

Dominican Republic. One reason is the confusion over certain technical aspects of the 1978 Foreign Investment Law. Under this law, existing foreign investments in certain controlled sectors do not have to divest, but all foreign investments are subject to the established reinvestment regulations. The law states that profits in excess of those currently allowable for repatriation (18% of foreign investment's registered capital per annum) may be reinvested. Confusion arose as to whether funds that are reinvested will increase the registered capital base upon which future profit repatriation is determined.

The promise of a new mining law also held uncertainties for foreign investors. A proposed mining law, drafted in 1977 was not submitted to the Dominican Republic's Congress in 1978. The Government set up another commission to revise the Mining Law of 1971. The revision was expected to be presented to Congress in early 1980 along with a recommendation to upgrade the status of the present General Directorate of Mining to that of a Ministry of Mining and Hydrocarbons. The mining program of the Government appeared to be firmly directed toward assuming a more positive role in minerals exploitation, including the use of service contracts and competitive bidding.

The continued escalation of gold and silver prices throughout 1978 and 1979 increased the gross earnings of Rosario Dominicana, S.A. Through taxes and a 46% ownership in the company, in 1978 the Government realized 76.2% of the profits from the mining operation. In response to congressional and public concerns that the Dominican Republic was indeed receiving adequate compensation from the mining operations, and in view of the widening trade deficit and increases in the market price of gold, in 1978 the Government initiated negotiations with Rosario to revise the 1976 contract.

In October 1979, the Government suddenly purchased for $70 million the 54% interest in Rosario Dominicana held by Rosario Resources Corp. and Simplot Industries, Inc. The loan for this purchase was obtained from four foreign banks at an undisclosed interest rate. Some reports have ventured that the Government was charged from 14% to 17.5% over 5 years. Rosario Resources gave its consent to manage the mining operation until the end of 1980.

At the end of 1978, Rosario's reserves of oxide ore were estimated at about 17.5 million tons grading 0.13 troy ounce of gold and 0.74 troy ounce of silver per ton. At the current rate of mining, these reserves would be exhausted in less than 5 years.

Exploration and development drilling of the large sulfide zone underlying the oxide ore body have not been completed, so the total potential sulfide reserves remain estimated at 21 million tons grading 0.11 troy ounce of gold and 0.84 troy ounce of silver per ton, with 1.40% zinc and 0.14% copper. Several types of sulfides are present in the ore body, and the determination of an acceptable metallurgical extraction process and more exact definitions of the deposit limits and geology are yet to be made.

Adjacent to Pueblo Viejo are the lower grade Monte Negro deposits where reserves have been estimated at about 15 million tons of oxide ore containing 0.12 troy ounce of gold and 0.45 troy ounce of silver per ton. Sulfide ore reserves at Monte Negro are estimated at 10 million tons containing 0.07 troy ounce of gold 0.39 troy ounce of silver, with minor amounts of zinc and copper.

In 1978, both the Dominican Republic's revenues and the financial status of Falconbridge Dominicana C. por A. suffered from the continuing depressed world market price for nickel and unfavorable producer and consumer inventories. In January 1978, Falconbridge closed a second electric melting furnace line, leaving only one of its three lines operational during the year. Concomitantly, the work force was reduced by one-fourth to about 1,550. By the end of 1978, inventories had been reduced, and the production lines were reactivated in 1979 when world nickel prices increased significantly.

In December 1977, the Aluminum Co. of America (Alcoa) and the Dominican Government agreed to a 6-month extention of an earlier agreement covering bauxite production levels, taxes, and royalty payments for the 1977 calendar year. In May 1978, a further extension was agreed upon, but in October another meeting ended inconclusively and no further discussions were held until late in 1979. Alcoa's Cabo Rojo bauxite operation is considered marginal and is the second smallest of similar operations in the world.

In July 1979, the Government agreed to a joint venture with a Spanish firm, Hullera Vasco-Leonesa S.A., for the exploration and exploitation of mineral deposits in a 4,000-hectare area in the central highlands along the Yujo River near the town of Jarabacoa.

Copper is the main exploration objective, although other minerals are also of interest. If gold or silver is found, the contract provides that terms will be renegotiated. Hullera received a renewable 15-year exploitation concession and will invest $6.5 million. For its share, the Dominican Republic contributed the property and mineral rights to the concession. Net profits of the venture are subject to a 40% income tax plus a sliding-scale tax ranging from 20% to 80% when dividends are greater than 20% of paid-in capital. Hullera will also contribute 5% of its annual net earnings to the town of Jarabacoa.

The Government has specified several mineral exploration projects for work—an evaluation of the Sierra de Bahoruco bauxite reserves in the southwestern part of the country, possibly in cooperation with Haiti, with the ultimate objective of constructing an alumina plant; an evaluation of the Mata Grande and Las Cañitas copper deposits; and an evaluation of the Monte Cristi and Hatillo iron deposits.

An agreement was signed with the United Nations for a minerals survey of the Cordillera Central. According to the agreement, the U.N. Revolving Fund would invest a minimun of $755,000 over a 6-year period. Later, the Government was concerned that some terms of the agreement could prove contrary to the country's best interest, and ratification was deferred pending renegotiation.

The four companies holding petroleum exploration and exploitation contracts were active during 1978 and 1979. Eastern Petroleum Dominicana, S.A., and Canadian Superior, Ltd., performed geophysical surveys on their concession in the Enriquillo Basin in the western region. Petrolera a Las Mercedes S.A., a private Venezuelan firm, concentrated its efforts on the area east of Santo Domingo. The consortium of Carboil Corp., Stalworth Oil and Gas, Inc., and Texas Crude Oil Corp., which has the concessions rights to the San Juan Basin located north of the Enriquillo Basin, accepted Weeks Petroleum Co. as a fourth partner. The Coporacion Dominicana de Electricidad (CDE), which had purchased the rights to old wells in the Maleno field, sold the rights back to Las Mercedes. Las Mercedes performed surveys on the Cibao Valley holdings of Quisqueya Oil S.A.

Table 7.—Dominican Republic: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite ore and concentrate	781,103	756,667	All to United States.
Metal including alloys, all forms	114	140	Mainly to United States.
Copper metal including alloys:			
Matte	20	--	
Scrap	903	97	Do.
Semimanufactures	1	--	
Gold dore and bullion thousand troy ounces	1,665	2,244	Switzerland 1,889; United States 355.
Iron and steel metal:			
Scrap	619	747	United States 564; Taiwan 123.
Ferroalloys: Ferronickel	59,946	50,007	Netherlands 23,662; United States 16,708; Japan 6,637.
Semimanufactures	43	49	Mainly to United States.
Zinc metal including alloys, all forms	74	102	West Germany 70; United Kingdom 32.
NONMETALS			
Cement, hydraulic	267	9,647	Surinam 2,400; Virgin Islands 2,134; Jamaica 1,683.
Clay products:			
Refractory	428	484	United States 366; Haiti 55; Virgin Islands 39.
Nonrefractory	140	569	United States 465; Haiti 88.
Fertilizer materials, manufactured	12,141	20,358	Martinique 6,521; Haiti 3,826; Grenada 2,250.
Gypsum and plasters	113,705	195,998	United States 119,647; Panama 23,201.
Lime	272	1,298	Mainly to Panama.
Pigments, mineral, natural	544	17	All to United Kingdom.
Salt	73	--	
Sand	98	150	All to United States.
Stone:			
Calcareous	182,508	258,081	United States 244,554; Surinam 13,073.
Granite	15	--	
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Distillate fuel oil 42-gallon barrels	60	--	
Bitumen and other residues do	333	2,012	Mainly to United States.

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Table 8.—Dominican Republic: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS		
Aluminum metal including alloys, all forms	6,724	3,056
Copper metal including alloys, all forms	1,419	1,341
Iron and steel metal:		
Scrap	15,282	17,026
Pig iron and ferroalloys	1,631	737
Steel ingot and equivalent forms	6,245	6,555
Semimanufactures	84,807	84,936
Lead metal including alloys, all forms	210	228
Manganese ore and concentrate	242	642
Nickel metal including alloys, all forms	16	4
Selenium kilograms	13	--
Tin:		
Ore and concentrate	10	--
Metal including alloys, all forms	31	38
Zinc:		
Ore and concentrate	50	99
Metal including alloys, all forms	2,483	1,785
Other:		
Uranium and thorium ores and concentrates kilograms	12	--
Ores and concentrates, n.e.s	26	7
Oxides, hydroxides, peroxides of metals	22	8
Base metals including alloys, all forms	(1)	5
NONMETALS		
Abrasives, natural:		
Crude emery, pumice, other	35	101
Grinding and polishing wheels and stones	274	208
Asbestos	540	519
Boron:		
Borax kilograms	6,905	39,721
Boric acid do	700	1,008
Cement, hydraulic	117.520	11,054
Chalk	191	338
Clays and clay products:		
Crude	677	3,062
Products:		
Refractory	8,298	6,057
Nonrefractory	67	18
Cryolite kilograms	2,125	--
Diatomite	511	1,100
Feldspar	103	--
Fertilizer materials:		
Crude: Phosphate rock	127	4
Manufactured:		
Nitrogenous	132,874	109,770
Phosphatic	11,360	8,823
Potassic	23,866	28,484
Mixed	17,341	16,838
Graphite	84	54
Gypsum and plasters	169	287
Lime	40	40
Magnesite	116	707
Pigments, mineral, natural	155	146
Slag from iron and steel manufacture	5	(1)
Stone, sand and gravel:		
Dimension stone	117	(1)
Alunite	4	2
Quartz and quartzite	58	17
Sand, all types	3,336	331
Strontium minerals kilograms	200	13,620
Sulfur	368	25
Other: Salt	64	83
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	10,109	2,958
Carbon black	314	456
Coal	342	168
Coke	373	432
Petroleum:		
Crude and unfinished oils thousand 42-gallon barrels	10,830	12,159
Refinery products:		
Gasoline do	27	21
Kerosine and jet fuel do	6	(1)
Distillate fuel oil do	109	62
Residual fuel oil do	294	39
Lubricants do	117	116
Bitumen do	175	255
Other do	34	35
Total do	762	528

[1] Less than 1/2 unit.

In August 1979, subsequent to public turmoil following a series of petroleum product price increases, it was reported that the Government would take over the 46% interest that Shell Petroleum Corp. holds in the Refinería Dominicana de Petróleo S.A. at Nagua.

HAITI

Bauxite remained Haiti's only significant mineral export, and there appeared to be little reason to anticipate any new developments in the immediate future. Bauxite exports from the Reynolds Haitian Mines netted the Government an estimated $9.8 million in taxes in 1978. In November 1978, a new cabinet-level Ministiere des Mines et Resources Energetiques was established.

In mid-1979, after reluctantly agreeing to price increases for petroleum products sold locally, the Government established Onacora-Petrole, a national office for the sale and refinery of petroleum products. Onacora operates within the dictates of the new Department of Mines and Energy and thus creates a mechanism by which Haiti can develop and promote its own energy potential. Onacora will be self-funded through profits.

Late in 1979, work was initiated on an economic feasibility study of the Maïssade lignite deposits. The project was part of a 1979 technical cooperation agreement between the Governments of Haiti and the Federal Republic of Germany. No developments were reported for the varous mineral exploration projects, notably copper, which have been underway for several years.

After evaluating data from three exploratory wells drilled in the Cul-de-Sac region and offshore in the Gulf of Gonâve in 1977, Crux International, Ltd., relinquished 590 square miles of its onshore and offshore petroleum concession in the Plaine du Nord area. No wells have been drilled in Haiti since that time. Hideca de Venezuela S.A. continued gravity surveys in the Plaine Centrale in 1978 and renewed its concession rights, but in mid-1979 Hideca apparently abandoned the project and the concession was assigned to a U.S. firm, Anschutz Corp. Anschutz will assume exploration costs and will drill at least two exploratory wells. Anschutz' concessions include a portion of east-central Haiti and the onshore and offshore areas of the southern peninsula west from about Les Cayes. No new seismic work was undertaken by Anschutz during 1979.

Table 9.—Haiti: Foreign trade in mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations/sources, 1977
EXPORTS			
Aluminum: Bauxite	738,758	700,707	All to United States.
Cement	70,849	89,804	French Guiana 30,360; Barbados 10,171; Ecuador 10,807.
Iron and steel scrap	96	1,155	Mainly to Dominican Republic.
IMPORTS			
METALS			
Aluminum metal including alloys, all forms	212	293	Belgium-Luxembourg 143; United States 125.
Copper metal including alloys, all forms	34	48	United States 31; Japan 6; United Kingdom 5.
Iron and steel:			
Ore and concentrate	119	53	All from United States.
Scrap	30	18	United States 17.
Semimanufactures[2]	15,978	13,312	Japan 5,651; Brazil 1,822; United States 1,790.
Lead metal including alloys, all forms	3	5	Belgium-Luxembourg 3; United States 2.
Platinum-group and silver metals including alloys:			
Platinum-group troy ounces	129	643	All from United States.
Silver do	2,508	64	Do.
Tin metal including alloys, all forms	1,070	504	Mainly from United States.
Other:			
Ores and concentrates	7	5	United States 4; Puerto Rico 1.
Base metals including alloys, all forms	1	1	Mainly from Puerto Rico.

See footnotes at end of table.

Table 9.—Haiti: Foreign trade in mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations/sources, 1977
NONMETALS			
Abrasives, natural: Grinding and polishing wheels and stones	12	4	Brazil 1; West Germany 1; United States 1.
Asbestos, crude	1	3	All from United States.
Cement	1,066	2,049	United States 1,378; Japan 364.
Clays and clay products:			
Crude	97	132	United States 61; Mexico 52.
Products, manufactured	931	1,061	West Germany 217; Spain 216; United States 143.
Fertilizer materials:			
Crude:			
Phosphatic	6	14	Mainly from Ecuador.
Potassic	19	58	United States 44; West Germany 14.
Manufactured, nitrogenous	15	([3])	All from United States.
Mica, worked and unworked, including splittings and waste	24	8	Mainly from United States.
Pigments, mineral, natural	139	194	United States 104; West Germany 40.
Salt	468	312	Jamaica 129; United States 95; Dominican Republic 68.
Stone, sand and gravel:			
Stone:			
Dimension, worked and partly worked	142	206	United States 84; France 70; Italy 52.
Industrial, except dimension	2,258	3,522	Mainly from Dominican Republic.
Limestone	4	7	All from United States.
Sand and gravel, including crushed quartz	114	186	United States 124; Netherlands 40; Mexico 21.
Other:			
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	273	143	Belgium-Luxembourg 52; United States 49; Spain 18.
Worked and unworked, n.e.s	3	1	Mainly from United States.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural	3,204	2,403	Netherlands Antilles 1,040; United States 607; Jamaica 524.
Coke agglomerates	20	24	Belgium-Luxembourg 20; Puerto Rico 4.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	90	113	Mainly from Netherlands Antilles.
Kerosine do	8	11	Do.
Distillate fuel oil do	774	1,035	Do.
Lubricants do	15	16	Netherlands Antilles 5; United States 5; Trinidad and Tobago 3.
Other:			
Liquefied petroleum gas do	22	22	Canal Zone 12; Surinam 6; United States 3.
Mineral waxes do	1	2	Mainly from United States.
Bituminous mixtures, n.e.s do	14	13	Mainly from Netherlands Antilles.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	8	2	Mainly from United States.

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[1] Data are for years ending Sept. 30 of that stated.

[2] Includes small quantities of pig iron, ferroalloys, and crude steel.

[3] Less than 1/2 unit.

JAMAICA

Throughout 1978 and 1979, Jamaica continued its efforts to solve major economic problems, which included a serious foreign exchange deficit, inflation, a high unemployment rate, a breakdown of private sector confidence, and continued emigration of skilled and managerial personnel. Preliminary data indicated that 1979 was the fifth consecutive year of negative economic growth.

In February 1978, the Government proposed that the bauxite companies make advance payments of the coming fiscal year's estimated bauxite levy by means of issuing promissory notes. The Government sold these notes to selected banks, partly for cash to improve reserves and partly as repayment of loans. The companies continued to remit monies due from the bauxite levy on a quarterly basis, but payments were made directly to the banks to redeem the notes.

Several actions were taken by the Government to encourage increased activity in

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the bauxite industry. The dual exchange rate had been instituted in April 1977 as an accompaniment to the first of several devaluations of the Jamaican dollar. The unfavorable rate had been applied exclusively to transactions of the bauxite-alumina companies and severely handicapped an industry already burdened by a high bauxite levy, a depressed world market, and increased operating costs in excess of productivity gains. In May 1978, however, responding to pressures from the bauxite industry and the International Monetary Fund, the dual exchange rate was unified.

Also in 1978, the Government reduced the bauxite levy from 8% to 7 1/2% of the averaged realized U.S. market price of aluminum ingots. The levy yielded the Government $193 million in revenues in 1978. The levy reduction, elimination of the dual exchange rate, and devaluations of the Jamaican dollar made the bauxite industry more competitive in world markets but the imposition of a 10% ad valorem stamp duty and increased labor costs reduced the beneficial impact.

Government negotiations with the bauxite producers during 1979 resulted in agreements providing for a further reduction of the bauxite levy based on a production incentive formula. The reduction was designed to maintain revenue income and restore mining and refining operations which have been producing at reduced levels since 1975. The agreements were reported as reducing the levy from 7 1/2% to 7% of the average realized ingot price of aluminum in the U.S. for production above a certain reference quantity. If the ingot price continues to rise, the percentage levy would be reduced. The agreement would be in force until 1983, by which time the levy rate could go as low as 5% or 6%. Other levy rates would be used for production over and above the operating companies' predetermined level in increments of 200,000 tons.

Total exports of bauxite and alumina during 1978 and 1979 did not change significantly from 1977 levels. All bauxite exports went to the U.S.; in 1978, four countries accounted for about 82% of Jamaica's 1978 alumina exports—the United States (28%), United Kingdom (26%), Norway (15%), and Canada (13%). Bauxite and alumina accounted for over 71% of the value of exports in 1978.

In 1978, Mexico withdrew from participation in Jalumex, the proposed Mexican-Jamaican aluminum smelter project planned for construction at Veracruz, Mexico, and from Javemex, the proposed joint Jamaica-Venezuela-Mexico alumina plant to be built at South Manchester, Jamaica. In the ensuing months, the Government secured an agreement from the U.S.S.R. to purchase 50,000 tons of alumina per year starting in 1980 and increasing to 250,000 tons per year in 1984. Agreements were also made for the sale of 150,000 tons of alumina per year each to Algeria and Iraq starting in 1984. An agreement to sell 150,000 tons per year of alumina to Hungary was cancelled since Hungary planned to resell the alumina on the world market.

These new contracts justified Jamaica's decision to proceed with plans for a 600,000 ton-per-year alumina plant at South Manchester. Financing the $500 million plant became an immediate consideration as construction would have to start in 1980 to ensure fullfillment of the 1984 alumina contracts. Plant designs have been prepared by Aluterv, the Hungarian engineering concern. Norway and Jamaica have held preliminary discussions regarding joint participation in the new alumina facility.

In September 1978, the Government of Jamaica, Alcan Jamaica, Ltd., and Aluminium Company of Canada, Ltd. (Alcan), announced they had reached agreement on the Government's acquiring a 7% participation in Alcan's integrated mining and refining operation. Jamaica's interest was vested in Jamaica Bauxite, Ltd., a state-owned company. The new joint venture, known as Jamalcan, became operational in November 1979 and is managed by Alcan and directed by a seven-member Board, on which Alcan has five members and the Government has two. The Government acquired all of Alcan's mineral lands at the lesser of book or market value. The new partnership will retain ownership of all land which contains the operational and support facilities of the mining and alumina operations. The Government granted a special 40-year mining lease to Jamalcan. Jamalcan will pay the Government a mining royalty of J$0.50 per dried long ton of bauxite until December 31, 1983.[5] The rated capacity of the facilities is 1,095,000 tons per year of alumina, and the Government's share would be 76,650 tons. A separate agreement provided that Jamaica's share of alumina can be bartered to Alcan for aluminum metal, which Alcan would then market on behalf of the Government.

The 1977 partnership agreement between Kaiser Bauxite Co. and the Government will become effective in February 1980 with the formation of the jointly-owned Kaiser Jamaica Bauxite Company. Kaiser will manage the new company.

In August 1978, the three neutral arbitrators appointed to rule on the disputed expropriation claim between Revere Copper and Brass, Inc., and Overseas Private Investment Corp. (OPIC) ruled unanimously that Jamaica's imposition of a high bauxite levy in 1974 was not confiscatory and that the levy itself did not justify recovery under the OPIC insurance contract. By a two-to-one majority the panel did find that the sum of Jamaican statements and actions amounted to a repudiation of the 1967 investment agreement between the Government and Revere and awarded Revere a settlement from OPIC of $1.1 million for this repudiation.

Revere's claim against OPIC was for $90 million, which included its $64 million investment insurance coverage, reimbursement of amounts paid on account of the bauxite levy and royalty payments imposed by the Jamaican Government, maintenance costs on the closed plant, all litigation expenses, and preaward interest. Revere refused to accept the $1.1 million and petitioned the U.S. District Court for the District of Columbia to correct or vacate that part of the arbitration award. The Court denied the petition and Revere appealed to the Circuit Court of Appeals in the District of Columbia. Arguments were presented in October 1979, but no decision had been reached by the end of the year. Should Revere accept the award, it must transfer its stock in Revere Jamaica Alumina, Ltd., to OPIC.

The Government negotiated the acquisition of the Caribbean Cement Co., Ltd., which operates a 400,000 tons per year plant at Kingston. Finalization of an agreement was expected in 1979. The Government's shares would be owned through the Jamaica National Investment Corp., the entity responsible for investing proceeds of the bauxite production levy. It was reported that some 4,000 shareholders who hold 8 million ordinary shares would be offered debentures in lieu of cash. Equipment to double capacity was available in storage near the plant and the Government expected to initiate expansion when financing becomes available.

Jamaica was also considering the construction of another cement plant to be undertaken jointly with Venezuela. The plant, with a proposed capacity of 600,000 tons per year, would supply cement for domestic use and for exports. In September 1978, Jamaica Gypsum Co. Ltd., a subsidiary of U.S. Gypsum Co., closed down its operations in the southwestern region of Bull Bay.

Funded by a $1.6 million grant from the Norwegian Government, 1978 geophysical exploration activity revealed that the Pedro Banks may offer a potential source of petroleum and natural gas. Invitations to bid for offshore exploration concessions were opened in 1979. Production-sharing franchise agreements were expected to be concluded by the end of December 1979. Legislation permitting petroleum exploration was enacted in 1979 and included production sharing, joint ventures, and service contract agreements with both state-owned and private foreign companies.

Onshore, two shallow exploratory wells drilled in 1978 were reported to have encountered shows of oil and gas. The newly formed state-owned company, Petrochemicals Jamaica Ltd., announced its intentions to initiate drilling in March 1980 at Windsor, St. Ann, near the resort area of Ocho Rios. Two other areas, one near Montego Bay and one near Savanna La Mar in the southwest, will also be explored. The $14 million exploratory program will be financed by the Government funds, possibly with the assistance of loans from the Inter-American Development Bank.

Table 10.—Jamaica: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite ore and concentrate thousand tons	6,355	6,448	All to United States.
Alumina do	2,034	2,320	United States 576; United Kingdom 555; Norway 314.
Metal including alloys:			
Scrap	651	22,817	United States 22,772.
Unwrought and semimanufactures	1,098	656	Trinidad and Tobago 441.
Copper metal including alloys, scrap	134	168	West Germany 108.
Iron and steel metal:			
Scrap	141	199	United States 106; United Kingdom 93.
Steel, primary forms	r2,168	--	
Semimanufactures	5,388	6,155	Trinidad and Tobago 4,140.
Lead metal including alloys, scrap	--	125	All to Japan.
Platinum-group metals including alloys, unwrought and semimanufactures value, thousands	r$17	$1	All to United States.
Silver metal including alloys, unwrought and semimanufactures do	r$78	$19	Do.
Tin metal including alloys:			
Scrap	r25,586	472	Do.
Unwrought and semimanufactures	235	216	Do.
Zinc metal including alloys, unwrought and semimanufactures	1	--	
Other:			
Scrap of nonferrous metals	77	45	All to United Kingdom.
Metals including alloys, unwrought and semimanufactures	(1)	--	
NONMETALS			
Abrasives	(1)	(1)	NA.
Cement, hydraulic	--	539	All to Cayman Islands.
Clays and clay products:			
Crude	2	5	All to United States.
Products:			
Refractory value	$3,113	$3,425	All to Cayman Island.
Nonrefractory	1	1	Do.
Fertilizer materials, manufactured, nitrogenous	--	218	All to Trinidad and Tobago.
Gypsum and plasters	248,400	152,816	All to United States.
Lime	97	479	Barbados 321; Guyana 152.
Salt	4,552	3,301	Trinidad and Tobago 1,952; Guyana 710; Barbados 572.
Stone, sand and gravel:			
Dimension stone, crude and worked	8	21	Cuba 12; United States 9.
Gravel and crushed stone	--	2	All to St. Lucia.
Sand, excluding metal bearing	(2)	1,016	All to Dominican Republic.
Sodium compounds, n.e.s.:			
Sodium carbonate	--	15	All to Trinidad and Tobago.
Caustic soda	1	300	France 132; Belgium-Luxembourg [illegible].
Sulfuric acid	939	150	Trinidad and Tobago 95; Haiti 38.
MINERAL FUELS AND RELATED MATERIALS			
Hydrogen, helium, rare gases	24	15	Trinidad and Tobago 10; Belize 4.
Petroleum:			
Crude thousand 42-gallon barrels	--	6	All to Nicaragua.
Refinery products:			
Gasoline do	48	21	Cayman Islands 12; Haiti 9.
Jet fuel and kerosine do	3	55	Puerto Rico 50; Haiti 3.
Distillate fuel oil do	199	213	Haiti 82; Netherlands Antilles 81.
Residual fuel oil do	51	--	
Lubricants do	193	208	Dominican Republic 22; Guyana 14; Bahamas 5.
Other:			
Nonlubricating oils, n.e.s do	8	(1)	NA.
Pitch and asphalt do	r13	18	Belize 7; Haiti 7.
Bitumen do	2	--	
Total do	r517	515	

rRevised. NA Not available.

[1] Less than 1/2 unit.

[2] Value only reported at $127.

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Table 11.—Jamaica: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1977	1978
METALS			
Aluminum:			
Oxide and hydroxide		^{r}5	33
Metal including alloys, unwrought and semimanufactures		3,624	4,475
Copper:			
Copper sulfate		85	46
Metal including alloys, unwrought and semimanufactures		1,793	795
Iron and steel:			
Ore and concentrate		1	--
Metal:			
Pig iron, ferroalloys, similar materials		182	278
Steel, primary forms		12,456	3,459
Semimanufactures		28,299	53,053
Lead metal including alloys, unwrought and semimanufactures		67	245
Magnesium metal including alloys, semimanufactures		3	([1])
Manganese ore and concentrate		362	303
Nickel metal including alloys, unwrought and semimanufactures		50	11
Platinum-group metals and silver:			
Ores and concentrates	value	$103	$8,072
Waste and sweepings	do	$3	--
Metals including alloys:			
Platinum-group	value, thousands	^{r}$8	$2
Silver	do	$468	$421
Tin metal including alloys, unwrought and semimanufactures		10,481	10,564
Uranium and thorium metals including alloys, unwrought and semimanufactures		--	1
Zinc metal including alloys:			
Blue powder		10	4
Unwrought and semimanufactures		1,318	1,352
Other:			
Ores and concentrates		38	50
Scrap of nonferrous metals, not further specified		24	137
Nonferrous metals including alloys, unwrought and semimanufactures		12	10
NONMETALS			
Abrasives, natural:			
Pumice, emery, natural corundum, etc		12	60
Dust and powder of precious and semiprecious stones	value	^{r}$103	$15
Grinding and polishing wheels and stones		44	136
Asbestos, crude, washed or ground		55	352
Barite, natural		25	25
Boron, crude, natural		1	--
Cement, hydraulic		145	946
Chalk		62	12
Clays and clay products:			
Crude		559	783
Products:			
Refractory[2]		395,796	52
Nonrefractory		3,014	4,094
Diamond:			
Gem, not set or strung	value, thousands	$80	$41
Industrial	do	^{r}$1	$1
Diatomite and other infusorial earth		47	4,599
Feldspar, fluorspar, cryolite, chiolite, nepheline syenite		6	8
Fertilizer materials:			
Crude:			
Nitrogenous		1	1
Phosphatic		--	2
Manufactured:			
Nitrogenous		22,507	25,714
Phosphatic		12,881	12,042
Potassic		8,717	5,722
Mixed		1,367	1,366
Ammonia		117	226
Graphite, natural		43	--
Gypsum and plasters		159	130
Lime		20	18
Magnesite, crude		5	11
Mica:			
Crude		98	138
Worked		--	([3])
Pigments, mineral, natural, crude		--	19
Precious and semiprecious stones	value, thousands	$59	$13
Sodium compounds:			
Sodium carbonate (soda ash)		4,969	4,946
Sodium hydroxide (caustic soda)		259,844	291,804
Other		16,101	9,309
Stone, sand and gravel:			
Dimension stone		75	28
Gravel and crushed stone		59	235
Limestone (except dimension)		13	28
Quartz, unground		457	20
Sand, including ground quartz		1,347	569

See footnotes at end of table.

Table 11.—Jamaica: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
NONMETALS —Continued		
Sulfur:		
Elemental	9,561	10,818
Sulfur dioxide	(3)	114
Sulfuric acid	15	22
Talc, steatite, soapstone, pyrophyllite	319	431
Other:		
Crude	18	46
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	748	222
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	19	40
Carbon gas	--	5
Coal and briquets	89	21
Coke and semicoke	345	446
Hydrogen, helium, rare gases	37	35
Peat, including peat briquets and litter value	$7,603	$2,985
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	7,079	6,974
Refinery products:		
Gasoline do	621	592
Jet fuel and kerosine do	315	90
Distillate fuel oil do	297	78
Residual fuel oil do	8,964	5,981
Lubricants do	54	56
Other:		
Liquefied petroleum gas do	320	257
Petroleum jelly and wax do	13	15
Nonlubricating oils, n.e.s do	624	531
Asphalt, bitumen, pitch, pitch coke do	2	10
Total do	11,210	7,612
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	7,463	121

[r] Revised.
[1] Value only reported at $592.
[2] Figures exclude glazed hearth and wall tiles of all materials valued at $228,258 in 1977 and $162,205 in 1978.
[3] Less than 1/2 unit.

MARTINIQUE AND GUADELOUPE

Guadeloupe's mineral industry is limited to construction-oriented materials, including a small, 180,000-ton-per-year-capacity cement plant at Pointe-á-Pitre. Martinique, with one small, 180,000-ton-per-year-capacity cement plant, was reported to have another plant coming onstream in 1978, but verification of this and data on plant capacity were not available.

The small refinery at Fort de France on Martinique imported crude oil from Venezuela and Saudi Arabia. The refinery products were used domestically and for export to Guadeloupe.

Table 12.—Martinique: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978
EXPORTS		
METALS		
Aluminum scrap	NA	13
Copper scrap	230	150
Iron and steel semimanufactures:		
Bars, rods, angles, shapes, sections	NA	72
Universals, plates, sheets	NA	16
Tubes, pipes, fittings	NA	5
Lead scrap	NA	35
Nickel scrap	NA	15

See footnotes at end of table.

Table 12.—Martinique: Foreign trade in selected mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
NONMETALS		
Cement	2,012	940
Clay products (including all refractory brick):		
Refractory (including nonclay brick)	NA	1,945
Nonrefractory	NA	69
Fertilizer materials, manufactured	NA	18
Stone, sand and gravel	NA	13
MINERAL FUELS AND RELATED MATERIALS		
Gas, hydrocarbon, natural	NA	6,976
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	501	373
Kerosine do.	533	368
Distillate fuel oil do.	223	173
Residual fuel oil do.	348	311
Liquefied petroleum gas do.	95	NA
Total do.	1,700	1,225
IMPORTS		
METALS		
Aluminum metal including alloys, all forms	77	114
Copper metal including alloys, all forms	68	60
Iron and steel metal:		
Pig iron, ferroalloys, similar materials	NA	5
Steel, primary forms	NA	827
Semimanufactures:		
Bars, rods, angles, shapes, sections	12,028	11,108
Universals, plates, sheets	3,512	3,539
Rails and accessories	NA	41
Wire	213	242
Tubes, pipes, fittings	2,632	5,986
Castings and forgings, rough	NA	62
Lead:		
Oxide	NA	5
Metal including alloys, all forms	NA	9
Tin metal including alloys, all forms	NA	17
Titanium oxide	NA	160
Zinc:		
Oxide	NA	10
Metal including alloys, all forms	NA	14
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc.	NA	10
Grinding and polishing wheels and stones	NA	27
Asbestos	NA	32
Cement	107,602	105,837
Chalk	NA	88
Clays and clay products (including all refractory brick):		
Crude	NA	57
Products:		
Refractory (including nonclay brick)	116	117
Nonrefractory	6,890	7,011
Diatomite and other infusorial earth	NA	11
Fertilizer materials:		
Crude	NA	302
Manufactured:		
Nitrogenous	3,866	4,219
Phosphatic	NA	100
Potassic	2,419	624
Other, including mixed	24,614	22,481
Ammonia	NA	19
Gypsum and plasters	8,730	6,612
Lime	1,517	606
Magnesite	NA	475
Pigments, mineral: Iron oxides, processed	NA	14
Salt	1,968	2,232
Sodium and potassium compounds, n.e.s.:		
Caustic soda	NA	115
Caustic potash and sodic and potassic peroxides	NA	2
Stone, sand and gravel:		
Dimension stone	87	109
Dolomite	NA	6,939
Gravel and crushed rock	NA	46
Sand, excluding metal bearing	NA	121
Sulfur:		
Elemental, all form	NA	7
Sulfuric acid	NA	113
Talc and natural steatite	NA	2

See footnotes at end of table.

Table 12.—Martinique: Foreign trade in selected mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
NONMETALS —Continued		
Sulfur —Continued		
Other:		
Crude	NA	259
Slag, dross, and similar waste, not metal bearing	NA	18
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s.	1,878	1,612
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	3,736	3,069
Refinery products:		
Gasoline do	NA	2
Distillate fuel oil do	5	NA
Lubricants do	26	26
Other:		
Liquefied petroleum gas do	4	NA
Bitumen and other residues do	32	NA
Unspecified do	NA	44
Total do	67	72
Coal, excluding briquets	NA	29
Gas, hydrocarbon, natural	NA	306
Hydrogen, helium, rare gases	NA	6
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	NA	42

NA Not available.

Table 13.—Guadeloupe: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum scrap	NA	29	Belgium-Luxembourg 10; West Germany 10; United States 9.
Copper scrap	NA	92	West Germany 85; Belgium-Luxembourg 7.
Iron and steel semimanufactures:			
Bars, rods, etc	NA	16	Montserrat 10; French Guiana 6.
Wire	NA	1	All to Dominican Republic.
Tubes, pipes, fittings	NA	6	All to Martinique.
Lead scrap	NA	37	All to West Germany.
NONMETALS			
Abrasives: Grinding stones value	NA	$1,000	NA.
Clay products, nonrefractory	NA	6	Dominican Republic 5; Montserrat 1.
Stone and gravel, calcareous, including marble value	NA	$2,000	All to Haiti.
Other, crude	NA	5,905	Do.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Kerosine 42-gallon barrels	202,058	--	
Lubricating oils do	NA	161	Martinique 77; Trinidad and Tobago 70; Haiti 7.
Mineral jelly do	NA	8	All to Martinique.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	NA	7	All to France.

NA Not available.

Table 14.—Guadeloupe: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Fused alumina (artificial corundum)	NA	12	All from France.
Metal including alloys, all forms	561	549	United States 325; France 147; Jamaica 67.
Chromium oxide and hydroxide	NA	1	All from France.

See footnotes at end of table.

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Table 14.—Guadeloupe: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Copper metal including alloys, all forms	87	86	France 68; Belgium-Luxembourg 15.
Iron and steel:			
Oxide and hydroxide	NA	3	All from France.
Metal:			
Pig iron, including cast iron value	NA	$1,000	Do.
Sponge iron, powder, shot	NA	1	Do.
Steel, primary forms	NA	1	All from Austria.
Semimanufactures:			
Bars, rods, etc	9,687	8,405	France 8,175; Italy 230.
Profiles	1,950	NA	
Sections	NA	2,626	France 2,589; Belgium-Luxembourg 55; Italy 32.
Universals, plates, sheets	3,763	3,472	France 3,389; Barbados 17; Netherlands 5.
Hoop and strip	--	4	All from France.
Rails and accessories	--	12	France 10; Belgium-Luxembourg 2.
Wire	1,066	1,060	All from France.
Tubes, pipes, fittings	3,731	4,568	France 4,379; Italy 108; Spain 33.
Castings, rough	186	91	France 81; Belgium-Luxembourg 10.
Lead metal including alloys, all forms	NA	12	All from France.
Nickel metal including alloys, all forms value	NA	$3,000	Do.
Silver metal, unworked or partly worked do	NA	$1,000	All from United States.
Tin metal including alloys:			
Unworked do	NA	$2,000	All from France.
Worked	NA	1	Do.
Titanium oxide	NA	5	All from West Germany.
Zinc:			
Oxide and peroxide	NA	1	All from France.
Metal including alloys, worked	NA	4	Do.
Other metals including alloys, all forms:			
Alkali and alkaline-earth metals value	NA	$3,000	Do.
Metalloids	NA	4	Do.
Base metals including alloys, all forms, n.e.s	NA	1	Do.
NONMETALS			
Abrasives:			
Natural	NA	8	Do.
Grinding stones	NA	4	France 3.
Asbestos, crude	NA	16	All from France.
Barium sulfate, natural	NA	28	Do.
Cement	107,213	159,130	Do.
Chalk	NA	130	Do.
Clays and clay products (including all refractory brick):			
Crude	NA	7	Do.
Products:			
Refractory	94	113	Do.
Nonrefractory	6,082	6,186	West Germany 2,118; Italy 2,008; France 1,930.
Fertilizer materials:			
Manufactured:			
Nitrogenous	7,410	7,106	Netherlands 5,595; United States 1,443; France 68.
Phosphatic	--	20	All from Belgium-Luxembourg.
Potassic	6,521	2,200	All from France.
Other	13,633	8,255	Netherlands 5,320; France 1,695; Belgium-Luxembourg 1,140.
Ammonia, anhydrous	NA	55	All from France.
Gypsum and plasters	10,941	12,910	France 9,510; Dominican Republic 3,400.
Infusorial earth	NA	21	All from France.
Magnesite	NA	405	Netherlands 190; France 170; Greece 45.
Mica, worked value	NA	$1,000	All from France.
Salt	2,940	2,061	Montserrat 1,080; West Germany 408; Netherlands 336.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	NA	184	France 173; Belgium-Luxembourg 10.
Soda ash value	NA	$1,000	All from France.
Stone, sand and gravel:			
Dimension stone, worked	NA	91	France 54; Italy 21; Portugal 16.
Calcareous stone, n.e.s	NA	20	All from France.
Dolomite	NA	600	France 598; Norway 2.
Gravel and crushed rock	NA	626	Other Caribbean Islands 600; United States 3.
Quartz and quartzite value	NA	$1,000	All from Switzerland.
Sand, excluding metal bearing	NA	4,779	Montserrat 4,703; France 76.
Other:			
Chlorine	NA	33	All from France.

See footnotes at end of table.

Table 14.—Guadeloupe: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Other —Continued			
Halogens, excluding chlorine value	NA	$2,000	All from France.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	2,506	2,445	France 2,427; United States 18.
Crude nonmetals, n.e.s	42	7	All from France.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	NA	13	Do.
Gas, natural and manufactured	11,154	10,788	Martinique 8,266; Venezuela 1,165.
Hydrogen and rare gases	NA	1	All from France.
Petroleum refinery products:			
Gasoline 42-gallon barrels	548,956	475,260	France 427,771; Trinidad and Tobago 47,489.
Kerosine and white spirit do	190,433	489,164	Martinique 433,186; Trinidad and Tobago 13,423.
Distillate fuel oil do	221,831	194,139	France 183,292; Trinidad and Tobago 10,847.
Residual fuel oil do	310,389	384,844	Martinique 337,762; France 47,073.
Lubricating oils do	31,206	27,811	France 13,489; Jamaica 5,117; Netherlands Antilles 3,129.
Other:			
Mineral jelly and wax do	--	24	Jamaica 16; West Germany 7.
Petroleum coke do	35,558	NA	
Bituminous mixtures, n.e.s do	45,381	50,246	Netherlands Antilles 45,941; France 2,289.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	NA	10	All from France.

NA Not available.

NETHERLANDS ANTILLES

The Shell Curacao N.V. refinery on Curaçao and the Exxon Lago refinery on Aruba continued to operate at a cost disadvantage in comparison with refineries located in the United States. The unprofitable operation of the refineries has had an adverse effect on the Netherlands Antilles through the loss of wages, increased unemployment, declining tax revenues, and increased balance-of-payments deficits.

Shell has indicated a willingness to accept one or more partners to share the burden of operating the refinery. Venezuela has held discussions with Shell regarding joint ownership. Both the Shell and Exxon refineries were designed to accomodate primarily Venezuela crude oil. An interest in the Shell refinery would give Venezuela an expansion of its export markets and also provide a new source of gasoline for its own increasing domestic use. The partnership would probably provide the refinery with a cost advantage on crude oil purchases. The Government of the Netherland Antilles was reported as a possible third partner in the venture.

The Government of Bonaire has been negotiating with Hess Oil of St. Croix, Virgin Islands, on the possibility of building a petroleum refinery next to the Bonaire Petroleum Corp. N.V. (BOPEC) oil transshipment terminal. No agreement was reached in 1979. The proposed $100 million refinery was expected to produce about 150,000 barrels per day.

In 1978, the Weeks Group, a consortium headed by Weeks Natural Resources, did not renew its petroleum exploration contract. The consortium conducted offshore seismic work in 1977.

Table 15.—Netherlands Antilles: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum metal including alloys, all forms	1	30
Copper metal including alloys, all forms	[r]46	5
Iron and steel metal:		
Scrap	7,461	4,543
Semimanufactures	70	123
Nickel metal including alloys, all forms	46	NA
Platinum-group and silver metals value, thousands	$1	$23
Other nonferrous metals including alloys, all forms	922	1,535
NONMETALS		
Cement	4,775	--
Fertilizer materials:		
Crude, phosphatic thousand tons	77	75
Manufactured do	103	42
Salt and brines do	131	NA
Stone, sand and gravel	--	1,524
Sulfur, elemental	50,740	14,946
Other	35	--
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:[1]		
Crude thousand 42-gallon barrels	6,463	11,482
Refinery products:		
Gasoline:		
Aviation do	1,069	1,060
Motor do	13,686	18,185
Jet fuel do	16,248	11,776
Kerosine and white spirit do	5,852	265
Distillate fuel oil do	20,657	21,246
Residual fuel oil do	109,043	91,069
Lubricants do	3,752	3,087
Other do	8,039	14,463
Total do	178,346	161,151
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	4,173	--

[r] Revised. NA Not available.

[1] International Petroleum Annual, 1976 and 1977.

Table 16.—Netherlands Antilles: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum metal including alloys, all forms	408	390
Copper:		
Copper sulfate	9	33
Metal including alloys, all forms	290	376
Iron and steel semimanufactures	16,874	17,277
Lead metal including alloys, all forms	81	48
Nickel metal including alloys, all forms	--	9
Silver metal including alloys, all forms value, thousands	$91	$38
Tin metal including alloys, all forms	16	19
Zinc metal including alloys, all forms	355	430
Other base metals including alloys	[1]6	5
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, industrial diamond	5	10
Grinding and polishing wheels and stones	14	--
Cement	82,075	72,697
Clays and clay products (including all refractory brick):		
Crude	313	859
Manufactured	[2]7,680	9,446
Diamond, gem, not set or strung carats	3,880	2,265
Fertilizer materials, manufactured	664	793
Gypsum and plasters	517	85
Lime	774	174
Mica, worked, including agglomerated splittings	1	--
Precious and semiprecious stones, except diamond troy ounces	108	17
Salt	749	890
Sodium and potassium compounds:		
Sodium carbonate	46	40
Caustic soda	14,945	19,505

See footnotes at end of table.

Table 16.—Netherlands Antilles: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity		1976	1977
NONMETALS —Continued			
Stone, sand and gravel:			
Dimension stone, worked and unworked		820	617
Crushed rock and sand		16,866	18,828
Sulfuric acid		2,009	18,223
Other, crude		3,372	4,300
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke and briquets thereof		26	11
Hydrogen, helium, rare gases		424	44
Petroleum:[3]			
Crude	thousand 42-gallon barrels	290,049	209,021
Refinery products:			
Gasoline, all grades	do	621	3,137
Jet fuel	do	256	1,088
Distillate fuel oil	do	1,045	1,843
Residual fuel oil	do	--	8,986
Lubricants	do	112	295
Other	do	695	6,080
Total	do	2,729	22,084
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		28	4

[1] Excludes quantity valued at $5,000.
[2] Excludes quantity valued at $10,556.
[3] International Petroleum Annual, 1976 and 1977.

TRINIDAD AND TOBAGO

Trinidad and Tobago continued the development of major energy-based industries supported to a large extent by the active petroleum sector. The Point Lisas industrial complex is the core of Government efforts to reduce economic dependence on oil and establish gas-fueled heavy industries. The increased industrial growth has stimulated employment opportunities.

In 1979, the Government announced that a new system of oil taxation will be introduced. The plan supposedly will abolish the tax reference price system currently used to calculate tax liability. The corporate tax rate of 45% will be applied instead of the petroleum profits tax rate of 50%. The refinery throughput tax will be replaced by the general corporation tax. A supplemental refinery tax is to be added which will be taken into account in computing the normal corporation tax liability.

COMMODITY REVIEW

Metals.—*Aluminum.*—The aluminum smelter project, which has been subject to some variation in capacity and ownership since originally conceived, appeared to be on the verge of receiving a positive decision to proceed. A feasibility and marketing study completed in 1978 viewed an aluminum smelter of between 135,000 and 180,000 tons per year as complementary to Trinidad and Tobago's industrial development program. In 1979, two U.S. companies, National Steel Co. and South Wire Aluminum Co., were chosen to be joint partners with the Government's National Energy Corp. in this $625 million project. A final decision for construction was expected in 1980. Sources for alumina input to the smelter remained undecided.

Iron and Steel.—The Iron and Steel Company of Trinidad and Tobago (ISCOTT) complex is scheduled for a mid-1980 startup. Armco, Inc., has agreed to provide iron ore and financial and technical assistance for the project. Armco has taken equity participation in the second Midrex direct reduction plant which will have the same 450,000-ton-per-year sponge iron capacity as the first plant. The first reduction plant is scheduled to come onstream in July 1980, and the second should be completed in 1982. At full production, some 200,000 tons per year of surplus sponge iron should be available for export.

Brazil has contracted to supply ISCOTT with 3 million tons of iron ore pellets over the next 10 years, an amount equal to about half of ISCOTT's pellet needs. The electric furnace steelmaking plant and rolling mill will produce about 750,000 tons per year of steel billets and rod, most of which is

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destined for the export market. Initial annual production is expected to be about 200,000 tons of billets and 70,000 tons of rod. The $300 million steel complex, when operating at full capacity, will employ some 1,000 workers. The Trinidad and Tobago Oil Co. (Trintoc) has agreed to construct a $5 million oxygen and nitrogen plant to service the ISCOTT complex.

Nonmetals.—*Cement.*—Construction projects at Point Lisas were somewhat hampered by the inability of the port facilities to accomodate the increased import of supplies and equipment. The construction industry has experienced a rapid growth due to industrial plant and infrastructural development projects as well as increased Government expenditures on nonindustrial projects.

In early 1978, the Government studied the advisability of constructing a new cement plant which would at first complement and then gradually replace the existing 270,000-ton-per-year facility of Trinidad Cement Ltd. Later in the year, it was announced that Voest-Alpine AG of Austria would construct a 950-ton-per-day plant scheduled to come onstream in 1981. The major portion of raw materials for cement manufacture are available locally. Limestone reserves are sufficient for 70 years at the current rate of extraction. In 1979, the Government reported that it would form a joint venture with Barbados to establish a cement plant in the latter country. Trinidad and Tobago will provide fuel and financial assistance to the project.

Fertilizer Materials.—The first of the Point Lisas industries, Trinidad Nitrogen (Tringen), came onstream in mid-1977. Tringen, a 400,000-ton-per-year anhydrous ammonia plant, is jointly owned by the Government and W. R. Grace Co. and expected to show a 1979 operation profit of $8.8 million. Fertilizers of Trinidad and Tobago (Fertrin), a $250 million joint venture of the Government (51%) and Amoco International Oil Co. (49%), should become operational in 1981. Fertrin will have a 2,300-ton-per-day capacity from two single-train, 1,150-ton-per-day ammonia plants.

Table 17.—Trinidad and Tobago: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS		
Aluminum metal including alloys, all forms	r2,964	46
Copper metal including alloys, all forms	r1,187	3,173
Iron and steel metal:		
Scrap	865	1,822
Steel, primary forms	9	132
Semimanufactures	r823	2,951
Lead:		
Ore	41	96
Oxide	14	142
Metal including alloys, all forms	r1	(1)
Platinum waste and sweepings troy ounces	--	3,601
Silver metal including alloys, all forms do	378,863	99,957
Tin metal including alloys, all forms kilograms	r10	51
Zinc metal including alloys, all forms	(1)	71
Other base metals including alloys, all forms kilograms	--	29
NONMETALS		
Abrasives, natural, n.e.s	(1)	1
Asbestos	1	--
Barite	1,021	1,469
Cement, hydraulic	3	29
Chalk	2	3
Clays and clay products:		
Crude	119	131
Products:		
Refractory	13	11
Nonrefractory[3]	42	87
Diamond, gem, not set or strung carats	--	58
Diatomite and other infusorial earth	2	--
Fertilizer materials:		
Manufactured:		
Nitrogenous	111,567	117,453
Other, including mixed	68	62
Ammonia	182,386	402,387
Gypsum	--	1
Lime	216	116
Mica	1	4
Salt	329	207
Sodium and potassium compounds	16	20

See footnotes at end of table.

Table 17.—Trinidad and Tobago: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
NONMETALS —Continued		
Stone, sand and gravel:		
Dimension stone:		
Crude	2	70
Worked	14	1
Gravel and crushed stone	11	1
Quartz	--	2
Sand	121	17
Sulfuric acid, including oleum	r181	90
Talc	8	4
Other: Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	1	7
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	170,731	1,500
Coal:		
Bituminous	1	--
Lignite	10	1
Hydrogen, helium, rare gases	15	3
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	58,700	58,969
Refinery products:		
Gasoline do	8,494	8,806
Kerosine and jet fuel do	7,852	5,647
Distillate fuel oil do	9,648	9,030
Residual fuel oil do	54,045	46,790
Lubricants do	716	526
Other:		
Mineral jelly and wax do	1	1
Liquefied petroleum gas do	169	262
Nonlubricating oils, n.e.s do	196	140
Bitumen and other residues do	45	10
Bituminous mixtures, n.e.s do	5	6
Total do	81,171	71,218

rRevised.

[1] Less than 1/2 unit.

[2] Partial figures; exclude quantities valued at $3,218 in 1977 and $4,990 in 1978.

Table 18.—Trinidad and Tobago: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS		
Aluminum:		
Alumina	104	386
Metal including alloys, all forms	2,745	2,902
Arsenic trioxide, pentoxide, acid	2	--
Copper:		
Copper sulfate	117	40
Metal including alloys, all forms	r2,151	687
Iron and steel:		
Ore and concentrate	3	--
Pig iron, ferroalloys, similar materials	53	5,281
Steel, primary forms	4,696	10,619
Semimanufactures:		
Bars, rods, angles, shapes, sections	102,877	244,299
Universals, plates, sheets	407,878	601,569
Hoop and strip	260	358
Rails and accessories	367	6
Wire	70,386	7,318
Tubes, pipes, fittings	288,224	397,400
Castings and forgings, rough	r8	14
Total	r870,000	1,250,964

See footnotes at end of table.

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Table 18.—Trinidad and Tobago: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS —Continued		
Lead:		
Oxide	292	333
Metal including alloys, all forms	739	817
Nickel metal including alloys, all forms	4	8
Platinum-group and silver metals including alloys:		
Platinum-group ... troy ounces	[r]4,308	2,154
Silver ... do	638,150	92,080
Tin metal including alloys, all forms	160	16
Zinc metal including alloys, all forms	[r]538	1,130
Other metals including alloys, all forms	18	7
NONMETALS		
Abrasives, natural, n.e.s.	[r]83	86
Asbestos	96	2
Barite and witherite	54,024	61,870
Cement	74,993	100,942
Chalk	691	686
Clays and clay products (including all refractory brick):		
Crude	7,186	7,134
Products[1]	4,833	1,521
Diamond ... carats	12,798	7,809
Diatomite and other infusorial earth	74	32
Feldspar	921	66
Fertilizer materials:		
Natural	230	424
Manufactured:		
Nitrogenous	146	54
Phosphatic	1,141	1,238
Potassic	2,111	5,075
Other, including mixed	379	524
Ammonia	2,748	101
Gypsum	49,166	10,396
Lime	680	381
Magnesite	63	---
Mica, all forms	137	205
Pigments, mineral	5	9
Precious and semiprecious stones, except diamond, natural and manufactured ... carats	111	23
Salt	12,823	18,364
Sodium and potassium compounds, n.e.s.:		
Sodium hydroxide	4,770	7,129
Potassium hydroxide and sodic and potassic peroxides	99	32
Stone, sand and gravel:		
Dimension stone:		
Crude	194	317
Worked	514	1,456
Gravel and crushed stone	1,691	1,707
Limestone	3,703	54,460
Quartz and quartzite	17	16
Sand	555	823
Sulfur:		
Elemental	7,728	23
Sulfuric acid and sulfur dioxide	2,394	741
Talc	679	609
Other, crude	1	20
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	120	103
Coal and coke and briquets thereof	1,238	501
Hydrogen, helium, rare gases	78	59
Peat	46	57
Petroleum:		
Crude and partly refined ... thousand 42-gallon barrels	62,376	56,651
Refinery products:		
Gasoline ... do	([2])	([2])
Kerosine and jet fuel ... do	---	([2])
Residual fuel oil ... do	246	101
Lubricants ... do	171	274
Liquefied petroleum gas ... do	3	3
Mineral jelly and wax ... do	6	6
Other ... do	21	23
Total ... do	447	407

[r] Revised.

[1] Partial figures; exclude quantities valued at $635,469 in 1977 and $161,224 in 1978.

[2] Less than 1/2 unit.

Mineral Fuels.—*Natural Gas and Petroleum.*—The much-publicized LNG project, a joint venture between the Government (51%), Tenneco Trinidad LNG, Inc. (24.5%), and Peoples Overseas Inc. (24.5%), a subsidiary of Peoples Gas Corporation, came closer to final approval when information presented in a gas reserves study commissioned by the Government showed that proven, discounted probable, and discounted possible natural gas reserves as of January 1, 1978, equaled 12.04 trillion cubic feet. The Ministry of Petroleum and Mines believed that increased drilling activity, the leasing of new areas, and improved recovery techniques could reasonably be expected to increase total natural gas reserves to 21 trillion cubic feet. In addition, the reserves study discounted probable and possible reserves by 50% and 80%, respectively.

Estimates of the natural gas that domestic industries will consume over the next 40 years, to the year 2017, equaled 8.6 trillion cubic feet, leaving about 4 trillion cubic feet for allocation to a 500-million-cubic-foot-per-day LNG plant. Huffington, Inc., of Texas, has been intergrated into the LNG project as a technical adviser but not as an equity partner. Some reports indicated that Texas Gas Transmission Corp. might become involved in the project. In the event another 250 million cubic feet per day becomes available as anticipated, 50% of it would be offered to Texas Gas and the remainder would be made available to the other partners. King Wilkinson, Inc., was selected to prepare designs and cost estimates for the plant and marine facilities as part of phase 1 of the project. A preliminary gas pipeline system study was underway.

The flaring of associated gas amounted to about 160 million cubic feet per day in 1978, and the waste of this non-renewable resource has been a subject of much concern to the Government. Utilization in 1978 amounted to about 62% of production and this should increase to about 75% when the Government finishes construction of its own platform to collect and compress about 50 million cubic feet per day of associated gas from Amoco Trinidad Oil Co., Ltd.'s petroleum concession off the east coast. The Government continued to utilize Amoco's offshore platform facilities and transported the gas to shore through the existing state-owned pipeline.

Under Regulation 94 of the Petroleum Regulations, the Minister of Petroleum and Mines is entitled to receive, without compensation to the licensee, any quantity of natural gas produced in association with crude oil which is not required by the licensee for his operations or sale.

The Government has placed a high priority on finding new sources of crude oil and natural gas. Oil production has been steadily declining, which reduces the economic gains that could be realized from increased world prices.

In 1979, the Government awarded three offshore exploration concessions to the Trinidad and Tobago Oil Co., Ltd., and to Mobil Oil Comany. In addition to new oil production, the Government hoped that further gas reserves will be found for use in the major industrial programs. Exploitaion will be through the initiation of production-sharing contracts.

It was reported that construction of drilling and production platforms began in Trinidad in 1978, and their use represented a significant cost reduction for petroleum companies. There has been no onshore exploration for several years, but toward the end of 1978, Occidental Oil Co. was granted an option to explore and develop some 86,000 acres in the Nariva area. Occidental conducted seismic studies in 1979. Also in 1979, the Government entered into negotiations for the purchase of Premier Consolidated Oilfields Ltd., a small producer that has been reported as operating at a loss for several years.

In late 1978, following the receipt of formal complaints against the Texaco Trinidad Inc. (TEXTRIN) refinery by the Oilfield Workers Trade Union (OWTU), the Government took measures to investigate the allegations against the refinery. OWTU also demanded the nationalization of the refinery.

Government negotiations for securing participation in the TEXTRIN refinery were initiated in 1974. Some reports suggested that discussions have been stalemated due to TEXTRIN's failure to release financial data. Other reports suggested that the lapse in negotiations was due to world recession in the refinery sector which forestalled any sense of urgency on the Government's part in obtaining state participation. Public reaction to OWTU'S complaints could act as a catalyst for reviving these negotiations. The investigation of TEXTRIN's activities was not concluded by the end of 1979.

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[1] Physical scientist, Branch of Foreign Data.

[2] Wall Street Journal. Mar. 15, 1979, p. 1; Aug. 20, 1979, p. 1.

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[6] Consists of Bulgaria, Cuba, Czechoslovakia, the German Democratic Republic, Hungary, Mongolia, Poland, Romania, the U.S.S.R., and Vietnam. Yugoslavia and North Korea have observer status.

[7] United Nations, Department of International Economic and Social Affairs, Statistical Office. World Energy Supplies 1973-1978 (New York). Statistical Papers, ser. J, No . 22, 1979.

[8] Owing to a series of devaluations of the Jamaican dollar (J$), conversion to a U.S. dollar equivalent is impractical. In May 1978, the exchange rate averaged J$1.55 = US$1.00; in December 1978, the exchange rate averaged J$1.70 = US$1.00; and in May 1979, the exchange rate averaged J$1.78 = US$1.00.

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The Mineral Industry of Central American Countries

By Doris M. Hyde[1]

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BELIZE

The economy of Belize continued to be relatively unaffected by activity in the minerals sector. Mining production consisted of limestone, marl, and sand and gravel. All production was used for domestic construction projects.

By the end of 1979 the major oil companies had, temporarily at least, ceased active exploration efforts. Esso Ventures, Inc., after drilling three dry holes in southern Belize, planned to reappraise its activities. The Reef Exploration, Ltd., concession was acquired by Anschutz Oil Co. (81.25%), with minority interests held by Anglo Oil Co. and Carolina Oil Co. The Anschutz group drilled offshore in the Gulf of Honduras and in Belize Harbor. Echo Exploration has a concession along the Mexican border and Spartan Petroleum Corp. obtained seven exploration licenses covering 768,000 acres in northern Belize. Spartan's concessions included about 130,000 acres offshore, with the remainder along the southeastern rim of the Yucatán Peninsula. Placid Oil Co. took an interest in the Spartan acreage and became operator. Seismic exploration was underway in 1979. A Mexican company, Pan American Oil and Gas, S.A., was awarded two exploration concessions, one in southern Belize and one near the Mexican border.

To date, the theory that there exists a relationship between the prolific Reforma and Campeche fields of Mexico and geologically similar strata in Belize has not resulted in any oil discoveries.

Table 1.—Central American countries: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
BELIZE[e]				
Stone, sand and gravel:				
Limestone	1,200,000	197,500	456,000	500,000
Marl	120,000	914,000	3,900,000	4,000,000

See footnotes at end of table.

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Table 1.—Central American countries: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978[p]	1979[e]
BELIZE[e] —Continued				
Stone, sand and gravel —Continued				
Sand and gravel	365,000	666,000	960,000	990,000
COSTA RICA				
Cement	361,988	405,907	425,432	544,300
Clays: Kaolin	500	460	530	550
Diatomite	717	680	610	635
Fertilizer materials, manufactured, gross weight:				
Nitrogenous	45,530	50,098	57,139	60,000
Mixed and unspecified	741	826	902	910
Gold[e] troy ounces	9,600	12,200	15,900	15,000
Lime	5,400	6,300	7,200	9,000
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	363	[e]757	1,807	1,900
Kerosine do	159	[e]285	233	230
Distillate fuel oil do	440	[e]444	3,824	4,000
Residual fuel oil do	719	[e]976	--	--
Other do	66	[e]172	--	--
Refinery fuel and losses do	37	[e]122	212	220
Total do	1,784	[e]2,756	6,076	6,350
Pumice	1,200	1,272	2,410	2,700
Salt, marine	20,000	27,000	34,470	36,000
Silver[e] troy ounces	1,608	1,350	1,640	2,000
Stone, sand and gravel:				
Crushed rock and rough stone cubic meters	450,000	518,000	385,000	300,000
Limestone and other calcareous materials	52,000	57,000	55,100	53,000
Sand and gravel cubic meters	190,000	224,000	222,000	225,000
EL SALVADOR				
Aluminum metal including alloys, semimanufactures	1,621	1,950	2,268	2,300
Cement	322,165	375,000	520,237	594,300
Fertilizer materials, manufactured:				
Nitrogenous	13,095	64,853	111,089	150,000
Phosphatic	20,061	21,249	27,135	30,000
Mixed	112,533	97,697	113,592	110,000
Gold, fine troy ounces	3,007	2,156	3,619	4,000
Gypsum[e]	6,000	7,000	7,000	7,000
Iron and steel metal:				
Steel, crude	[e]11,000	13,600	13,600	NA
Semimanufactures	21,358	27,575	37,907	38,000
Limestone	486,016	560,000	750,000	800,000
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	1,095	1,213	1,236	1,250
Jet fuel do	[r]85	85	93	90
Kerosine do	[r]371	372	385	390
Distillate fuel oil do	1,469	1,601	1,665	1,700
Residual fuel oil do	1,763	1,678	1,412	1,400
Other:				
Liquefied petroleum gas do		316	294	300
	147			
Asphalt do		134	163	160
Refinery fuel and losses do	237	84	106	110
Total do	[r]5,167	5,483	5,354	5,400
Salt[e]	23,000	25,000	27,000	27,000
Silver, fine troy ounces	166,289	112,245	185,060	185,000
GUATEMALA				
Antimony, mine output, metal content	1,120	918	230	227
Cement	445,369	490,848	515,079	[3]573,643
Clays:				
Bentonite	[e]10	--	2,593	2,700
Other	96,375	104,880	124,991	126,000
Copper, Cu content of concentrates	2,889	2,064	2,700	2,500
Feldspar	[e]20,000	13,071	15,377	13,000
Gypsum, crude:				
For cement manufacture	13,696	13,324	15,213	18,323
Other	NA	18,835	22,559	7,086
Iron ore, gross weight	2,578	3,166	4,755	5,000
Lead:				
Mine output, metal content	[e]100	127	[e]100	100
Metal, including secondary	110	127	119	120
Lime	45,514	45,581	44,292	45,500
Nickel, mine output, metal content[2]	--	298	1,814	8,600

See footnotes at end of table.

Table 1.—Central American countries: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^{p}	1979^{e}
GUATEMALA —Continued				
Petroleum:				
Crude thousand 42-gallon barrels	^{r}51	110	^{e}219	220
Refinery products:				
Gasoline thousand 42-gallon barrels	927	1,111	1,225	1,300
Jet fuel do	229	265	321	350
Kerosine do	218	233	243	250
Distillate fuel oil do	1,698	1,474	1,886	2,000
Residual fuel oil do	1,875	2,009	2,160	2,200
Other: Liquefied petroleum gas and unspecified do	68	43	51	53
Refinery fuel and losses do	172	63	72	80
Total do	5,187	5,198	5,958	6,230
Salt	10,924	10,610	10,797	10,800
Silver, mine output, metal content troy ounces	NA	NA	10,000	10,000
Stone, sand and gravel:				
Crushed and broken:				
Limestone thousand tons	945	941	825	800
Pumice do	NA	NA	20	20
Volcanic ash do	24	26	35	36
Unspecified (ballast, etc.) do	NA	903	^{e}900	900
Marble cubic meters	1,337	1,492	1,171	1,000
Quartz	2,755	2,600	2,500	2,400
Sand and gravel:				
Silica sand	NA	40,074	43,370	44,000
Other cubic meters	868,369	844,223	788,605	750,000
Zinc, mine output, metal content[3]	457	1,024	1,000	1,000
HONDURAS				
Antimony, mine output, metal content	117	70	^{e}100	100
Cadmium, mine output, metal content	231	253	260	260
Cement	222,170	377,000	260,000	272,000
Copper, Cu content of lead and zinc concentrates	364	535	600	1,000
Gold troy ounces	2,280	2,481	^{e}2,500	2,500
Gypsum	^{e}10,000	18,144	^{e}22,600	22,600
Iron and steel semimanufactures	NA	26,308	25,000	24,000
Lead, mine output, metal content	18,590	23,541	21,800	10,000
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	701	713	690	650
Jet fuel do	77	76	74	70
Kerosine do	270	299	289	250
Distillate fuel oil do	1,368	1,251	1,211	1,200
Residual fuel oil do	891	616	596	550
Other: Liquefied petroleum gas and unspecified do	72	60	58	50
Refinery fuel and losses do	71	273	264	250
Total do	3,450	3,288	3,182	3,020
Salt	^{r} ^{e}32,000	32,600	32,600	32,600
Silver thousand troy ounces	3,184	2,819	2,788	3,000
Stone:				
Limestone	NA	496,457	500,000	500,000
Marble	NA	42,184	43,000	43,000
Zinc ore and concentrate, metal content	24,850	26,542	24,300	22,000
NICARAGUA[4]				
Cement	208,717	220,766	160,500	181,400
Copper, mine output, metal content	1,264	500	^{e}100	--
Gold, mine output, metal content troy ounces	75,841	65,764	^{e}65,800	60,000
Gypsum and anhydrite, crude^{e}	30,000	36,000	36,000	36,000
Lead ore and concentrate, metal content	^{r}1,273	956	400	--
Lime^{e}	^{r}26,300	^{r}36,000	37,000	36,000
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	1,010	1,207	1,421	1,400
Jet fuel do	185	225	214	200
Kerosine do	145	117	124	100
Distillate fuel oil do	1,231	1,388	1,328	1,300
Residual fuel oil do	1,650	1,762	1,695	1,600
Other:				
Liquefied petroleum gas do	188	185	186	180
Asphalt do	150	112	^{e}110	100
Unspecified do	67	58	^{e}59	50

See footnotes at end of table.

Table 1.—Central American countries: Production of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978^p	1979^e
NICARAGUA[4] —Continued				
Petroleum refinery products —Continued				
Refinery fuel and losses .... do.	211	122	122	110
Total .... do.	4,837	5,176	5,259	5,040
Salt, marine^e	^r14,200	16,000	18,000	18,000
Sand .... cubic meters	NA	^e76,038	^e80,000	80,000
Silver, mine output .... troy ounces	208,217	153,492	482,000	300,000
Zinc ore and concentrate, metal content	14,330	10,142	3,600	--
PANAMA				
Cement	282,673	270,672	264,900	272,000
Clays and clay products:				
Crude	272,012	207,611	183,019	150,000
Products .... cubic meters	45,128	34,157	35,522	36,000
Petroleum refinery products:				
Gasoline .. thousand 42-gallon barrels	^e2,343	^e2,500	2,372	2,400
Jet fuel .... do.	^e1,936	^e1,850	1,146	1,100
Kerosine .... do.	^e143	^e250	83	100
Distillate fuel oil .... do.	^e4,626	^e4,500	4,563	4,500
Residual fuel oil .... do.	^e9,639	^e10,100	7,426	7,500
Other:				
Liquefied petroleum gas .... do.	^e346	--	312	300
Asphalt .... do.	^e101	^e50	91	90
Unspecified .... do.	^e407	^e1,350	221	300
Refinery fuel and losses .... do.	^e838	^e800	723	700
Total .... do.	^e20,379	^e21,400	16,937	16,990
Salt, marine	12,514	21,021	15,233	15,400
Stone, sand and gravel:				
Limestone[3]	211,381	307,371	416,363	450,000
Other .... thousand cubic meters	398	371	360	350

^e Estimate. ^p Preliminary. ^r Revised. NA Not available.

[1] Reported figure.

[2] Ni content of sinter.

[3] Exports.

[4] In addition to the commodities listed, Nicaragua produces a small but undetermined quantity of cadmium contained in zinc concentrates for export.

[5] Excludes 8,000 cubic meters per year.

COSTA RICA

External events during 1978-79 negatively influenced Costa Rica's economy. The civil conflict in Nicaragua resulted in a cutoff of traditional sources of raw materials as well as transportation links with other Central American countries which represent both buyer and seller for Costa Rican trade. Imports cutoff completely or on an interrupted basis included resins, gypsum for the cement industry, and paint pigments. Efforts to bypass the closed Nicaraguan border by using sea routes met with limited success.

Problems associated with a rising inflation rate and an increasing trade deficit were aggravated by the escalating cost of oil imports. In 1977 oil imports amounted to $93.8 million, or 9.4% of total imports; in 1978 the cost rose to $123.2 million, representing 10.4% of total imports; for 1979 oil imports costs were estimated at $190 million, about 14% of total imports.

No petroleum exploration rights are held in Costa Rica and the issuance of mineral exploration permits has been at a virtual standstill. New mining and petroleum legislation designed to encourage foreign investment and at the same time protect the national interest has been under contemplation for several years.

As Costa Rica's hydroelectric capacity is expanded, the demand for imported oil should lessen. The Government electric utility, Insituto Costarricense de Electricidad (ICE), expected its oil consumption to decrease after the late 1979 inauguration of the 157-megawatt first stage of the Arenal hydroelectric project. Looking ahead, ICE also estimated that oil imports for electricity generation will not be required after 1981. Financing has been obtained for the Corobici power project, a 174-megawatt facility, which will also use Lake Arenal to power the generating units. Corobici should

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be operational in 1983, at which time the country's total hydroelectric capacity will be 768 megawatts. Final design studies were underway for the future construction of the 760-megawatt Boruca hydroelectric project on the Río Grande de Térraba, upstream from Palmar Norte in southern Costa Rica.

A large portion of Boruca's output would supply a proposed 300,000-ton-per-year primary aluminum processing plant which Martin Marietta Aluminum Corp. is interested in building in Costa Rica. The feasibility of the aluminum smelter construction has been keyed to the availability of economical electric power from Boruca.

In mid-1979 Costarricense de Desarrollo S.A. (Codesa), the State development corporation, outlined plans for developing bauxite reserves in El General Valley. The continuing bauxite feasibility studies include refining and smelting facililties. The bauxite deposits under investigation incorporate and extend beyond the former Aluminum Co. of America (Alcoa) concession which was abandoned in 1976 as uneconomical due to the low grade of the ore (30% alumina content). Martin Marietta has not participated in Codesa's bauxite investigations.

United Hearne Resources completed its feasibility study for the Santa Clara gold property. The ore reserves estimate was increased to 6 million tons with a cutoff grade of 0.03 ounce of gold per ton and included about 3.6 million tons of minable ore grading 0.07 ounce of gold per ton. Tests were conducted using a cyanide leaching process and a 90% gold recovery was obtained.

Test cores taken from the Osa Peninsula in southern Costa Rica revealed gold mineralization. Of 25 test holes, 13 contained material grading up to 0.03 gram of gold per cubic meter and 5 holes were graded between 0.99 and 3.7 grams of gold per cubic meter. Metro International Corp. holds claims to about 740 acres on the peninsula. Barranca Corp. has an interest in the Metro properties, as well as a 30% interest in Hearne's Santa Clara gold mining operation.

Table 2.—Costa Rica: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal destinations, 1976
METALS			
Aluminum metal including alloys, unwrought and semimanufactures	331	264	Nicaragua 82; El Salvador 68; Guatemala 57.
Copper metal including alloys, all forms	--	38	Panama 34.
Iron and steel metal including alloys, all forms	7,641	21,041	Nicaragua 12,482; El Salvador 4,029; Panama 2,659.
Zinc metal including alloys, all forms	--	3	All to Nicaragua.
Other nonferrous base metals including alloys, all forms	[1]58	2	Do.
NONMETALS			
Abrasives, natural: Grinding and polishing wheels and stones	114	153	Mainly to Nicaragua.
Cement	2,705	3,996	Mainly to Panama.
Clays and clay products (including all refractory brick)	135	217	Nicaragua 174; Honduras 37.
Diatomite and other infusorial earth	780	1,280	All to El Salvador.
Fertilizer materials, manufactured:			
Nitrogenous	16,465	12,099	Mexico 10,849; Panama 1,129; Honduras 120.
Potassic	80	1	All to Panama.
Other, including mixed	51,209	92,171	Mexico 53,442; Panama 19,909; Nicaragua 5,973.
Lime	208	587	Panama 442.
Stone:			
Dimension	76	44	All to Guatemala.
Other	1,409	1,438	Panama 1,147; El Salvador 176; Honduras 66.
Other: Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	398	4,188	Guatemala 2,472; Honduras 1,385; Panama 261.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	([2])	([2])	All to bunkers.
Distillate fuel oil do	17	41	Mainly to bunkers.
Lubricants do	([2])	1	All to bunkers.

[1] May include aluminum scrap.
[2] Less than 1/2 unit.

Table 3.—Costa Rica: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
METALS[1]			
Aluminum metal including alloys, all forms	2,593	3,924	France 1,145; United States 1,021; El Salvador 453.
Copper:			
Copper sulfate	17	17	United Kingdom 10; West Germany 6.
Metal including alloys, all forms	1,565	1,967	Chile 1,237; United States 189; Mexico 158.
Iron and steel metal:			
Scrap	4	([2])	All from United States.
Pig iron, ferroalloys, similar materials	428	405	West Germany 384; Brazil 21.
Steel, primary forms	28,854	44,549	United States 29,283; Canada 8,732; Chile 4,166.
Semimanufactures	60,274	84,954	Japan 62,802; West Germany 5,524; United States 4,704.
Lead metal including alloys, all forms	144	277	Panama 101; Denmark 82; United States 29.
Nickel metal including alloys, all forms	6	6	United States 3; Japan 1; United Kingdom 1.
Platinum-group metals including alloys, all forms troy ounces	8,649	9,099	All from United States.
Silver metal including alloys, all forms do	8,906	65,137	France 52,019; United States 9,099; Canada 3,922.
Tin metal including alloys, all forms	1,158	3,495	Mexico 2,361; Canada 432; Japan 288.
Other:			
Ores and concentrates of nonferrous base metals	502	816	Mexico 519; Japan 295.
Waste and scrap of nonferrous base metals	10	6	All from Panama.
Metals:			
Pyrophoric alloys	1	1	Mainly from United States.
Nonferrous base metals including alloys, all forms, n.e.s	16	11	United States 9; Spain 1.
NONMETALS			
Abrasives, natural, n.e.s	79	75	West Germany 23; United States 19; United Kingdom 8.
Asbestos	2,974	1,417	Canada 1,087; Botswana 151; Australia 83.
Boron materials, oxide and acid	45	24	United States 17; West Germany 5; Turkey 2.
Cement	3,783	3,248	Japan 1,709; Belgium-Luxembourg 1,497.
Clays and clay products (including all refractory brick):			
Crude	1,763	2,445	United States 1,309; United Kingdom 631.
Products:			
Refractory (including nonclay brick)	2,018	1,333	United States 761; Canada 470; Spain 49.
Nonrefractory	4,438	3,632	Nicaragua 2,794; Panama 125; United States 107.
Diamond, industrial carats	15,000	135,000	Guatemala 115,000; United States 15,000.
Diatomite and other infusorial earth	300	440	Mexico 386; Nicaragua 28; United States 25.
Feldspar, fluorspar, cryolite	311	804	Nicaragua 510; Guatemala 185; United States 106.
Fertilizer materials:			
Crude: Phosphatic and potassic	1	9	West Germany 8.
Manufactured:			
Nitrogenous	49,358	26,821	Netherlands 6,360; Trinidad and Tobago 4,895.
Phosphatic	56,329	88,277	United States 61,915; Mexico 22,838.
Potassic	47,296	45,715	United States 23,283; Canada 10,429.
Other, including mixed	5,615	14,332	Mexico 5,160; Colombia 4,209; West Germany 3,333.
Graphite, natural	8	17	West Germany 7; Canada 5; Netherlands 5.
Lime	785	877	Nicaragua 776; Guatemala 86.
Mica, all forms	17	20	West Germany 10; United States 10.
Precious and semiprecious stones, including gem diamond kilograms	45	71	United States 21; West Germany 19.
Salt and brines	7,691	8,931	Nicaragua 8,145; United States 534.
Sodium compounds, n.e.s.:			
Caustic soda	4,491	4,790	Nicaragua 4,551; United States 141.
Soda ash	978	1,313	Netherlands 896; West Germany 313; Colombia 80.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	477	564	Nicaragua 359; Guatemala 108; Italy 96.

See footnotes at end of table.

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Table 3.—Costa Rica: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976	Principal sources, 1976
NONMETALS —Continued			
Stone, sand and gravel —Continued			
Dimension stone —Continued			
Worked	55	34	Guatemala 19; Nicaragua 14.
Industrial stone	52	28	United States 17; Nicaragua 11.
Sand and gravel and crushed rock, n.e.s	644	206	United States 195; Taiwan 11.
Other	(2)	1	All from United States.
Sulfur:			
Elemental, all forms	160	100	Do.
Sulfur dioxide	19	(2)	Do.
Sulfuric acid	450	555	El Salvador 389; Guatemala 137.
Talc, soapstone, pyrophyllite	439	591	United States 344; Italy 122; Taiwan 80.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	1,652	1,842	Venezuela 925; Colombia 722; United States 137.
Coal and coke, including briquets	503	393	West Germany 222; Colombia 91; United States 64.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	1,995	1,839	Venezuela 1,345; Netherlands Antilles 494.
Refinery products:			
Gasoline do	672	712	Venezuela 523; Netherlands Antilles 130.
Kerosine do	91	97	Trinidad and Tobago 48; United States 25.
Distillate fuel oil do	1,905	1,790	Venezuela 1,465; Netherlands Antilles 325.
Lubricants do	107	115	United States 41; Netherlands Antilles 30.
Other:			
Liquefied petroleum gas do	99	96	Panama 84; Nicaragua 11.
Naphtha do	(2)	(2)	Mainly from Netherlands Antilles.
Paraffin do	17	15	West Germany 11; United States 2.
Petrolatum do	1	2	Mainly from United States.
Unspecified do	103	91	Do.
Total do	2,995	2,918	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	2,010	2,263	NA.

NA Not available.
[1] Metal oxides and hydroxides are excluded, as they were reported inseparably from metal salts and other compounds.
[2] Less than 1/2 unit.

EL SALVADOR

In 1978 real economic growth in El Salvador amounted to 4.2%, a decrease from the 5.2% growth rate obtained during 1977. By mid-1979, a 4.5% growth rate was expected for that year, but an unexpected change of government leadership and continued political, civil, and economic instabilities made this estimate unreliable and less than a 2.0% rate appeared more likely at yearend.

The mineral industries contributed an insignificant amount to the gross domestic product in 1978. Gold and silver continued to represent the major mining activity with 1978 production valued at approximately $2.5 million. Other mining activity consisted primarily of construction-oriented material.

In July 1979, a new hydrocarbon law was submitted to the legislature. The law follows the service contract model. All petroleum resources were declared property of the State which may contract with private entities for exploration and exploitation. The risks and cost of exploration would be borne by the private company. In the event of a commercial discovery, a joint venture with the State would be formed for exploitation. No legislative action was taken during 1979 on the proposed hydrocarbon law. There have been no petroleum exploration permits issued in El Salvador.

El Salvador's oil import costs have risen steadily. In 1973 they represented 5.9% of export earnings; in 1978, the proportion had increased to 16%; and 1979 costs have been estimated at 19% of export earnings. The country consumes a high proportion of light petroleum products, such as diesel fuel, kerosine, and liquid petroleum gas. Conservation measures and price increases were expected to help hold the petroleum consumption increase to about 2% during 1979.

Hydroelectric and geothermal resources provided 304.2 megawatts of electric power capacity, more than enough for current use. An additional 186.8 megawatts are available from thermal plants which have been taken offline as representing surplus capacity. This action reduced petroleum consumption by 800,000 barrels per year. The thermal plants are maintained but only brought online during the dry season. Total potential geothermal capacity at Ahuachapán has been placed at 300 megawatts. Present installed capacity is 60 megawatts. Potential unused hydroelectric resources were estimated at 840 megawatts, but 500 megawatts of this must be considered as tentatively potential due to its geographic location along the Honduran border. Abundant power provides El Salvador the ability to expand industrially without undue concern for the growth of exports to pay for petroleum import costs.

Minas San Cristóbal S.A., opened its Los Encuentros Mine in 1979, processing the gold-silver ore at the San Cristóbal mill. The company also owns the El Divisadero Mine and holds an option on the Monte Mayor silver-gold mine located northeast of the Divisadero property.

Assessment activities continued on the Zancudo and Minita veins in the old El Dorado Mine, located in the Department of Canabus, which had ceased operation around 1950. Work has been carried out by Bruneau Mining Corp., a Canadian company.

In late 1979 it was reported that the Instituto Salvadoreno de Desarrollo Industrial (INSAFI) and the Comisión Nacional de Petróleo (CONAPE) have begun a $1.5 million geological survey to locate exploitable mineral deposits.

Table 4.—El Salvador: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976
METALS		
Aluminum metal including alloys, all forms	1,424	2,016
Copper metal including alloys, all forms	84	(1)
Iron and steel semimanufactures	10,570	8,710
Lead metal including alloys, all forms	--	18
Platinum-group metals including alloys, all forms troy ounces	1,479	--
Silver metal including alloys, all forms do	176,411	168,534
Tin metal including alloys, all forms	7	8
Zinc metal including alloys, all forms	--	1
Other: Ash and residue containing nonferrous metals	62	364
NONMETALS		
Abrasives, natural	190	167
Cement	66	168
Clays:		
Kaolin	317	1,384
Refractory, unspecified	1	2
Fertilizer materials	28,615	69,650
Lime	5	39
Salt	19,270	20,337
Stone:		
Crude and partly worked	45	1
Worked	66	245
Sulfuric acid	1,895	1,920
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	--	(1)
Distillate fuel oil do	20	10
Lubricants do	83	81
Liquefied petroleum gas do	47	46
Unspecified do	110	77

[1] Less than 1/2 unit.

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Table 5.—El Salvador: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976
METALS		
Aluminum metal including alloys:		
Unwrought	648	1,835
Semimanufactures	1,614	3,245
Copper:		
Copper sulfate	1	14
Metal including alloys, all forms	1,540	2,762
Iron and steel metal:		
Scrap	44	30
Pig iron, ferroalloys, similar materials	133	166
Steel, primary forms	27,074	10,626
Semimanufactures	37,809	51,733
Lead metal including alloys, all forms	250	191
Platinum-group metals troy ounces	32	64
Silver:		
Ore and concentrate do.	11,863	24,499
Metal including alloys, all forms do.	23	21
Tin metal including alloys, all forms	498	537
Zinc metal including alloys, all forms	--	289
Other:		
Ores and concentrates	3	1
Ash and residue containing nonferrous metals	51	(1)
Base metals including alloys, all forms	8	2
NONMETALS		
Abrasives, natural	1,359	1,043
Asbestos	3,866	2,637
Cement	11,036	7,020
Clays and clay products (including all refractory brick):		
Crude:		
Kaolin	4,322	3,634
Refractory, unspecified	93	255
Products	2,030	2,401
Diamond, industrial thousand carats	175	1,115
Diatomite and other infusorial earth	1,295	2,335
Feldspar and fluorspar	1	1
Fertilizer materials, crude and manufactured:		
Nitrogenous	181,145	297,235
Phosphatic	48,439	45,770
Potassic	8,022	1,268
Other, including mixed	22,886	30,636
Graphite, natural	4	64
Gypsum and plasters	8,425	8,385
Lime	6,889	5,599
Mica, all forms	4	4
Pigments, mineral, crude	2,399	1,986
Salt	55	84
Sodium compound, n.e.s.:		
Sodium carbonate	1,258	1,321
Sodium hydroxide	6,298	7,915
Stone, sand and gravel:		
Dimension stone	3,617	4,263
Gravel and crushed rock	930	1,244
Sand	682	199
Sulfur:		
Elemental, all forms	4,520	5,186
Sulfuric acid	1,021	7,708
Talc, soapstone, pyrophyllite	140	127
Other	312	257
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	53	4,978
Coal and coke, including briquets	572	501
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	3,623	3,603
Refinery products:		
Gasoline do.	30	27
Kerosine do.	12	16
Lubricants do.	34	40
Other:		
Liquefied petroleum gas do.	(1)	(1)
Mineral jelly and wax do.	13	17
Unspecified do.	1	1
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	52	34

[1] Less than 1/2 unit.

GUATEMALA

Guatemala's real economic growth continued to slow, falling from 8.3% in 1977 to 5.5% in 1978 and an estimated 4.5% in 1979. In 1978, the gross domestic product was about $5.8 billion in terms of 1976 dollars. The rate of inflation decreased from 12.6% in 1977 to about 8% in 1978. In 1979, the rate climbed to an estimated 11%, among the lowest in Latin America where inflation growth averaged about 27% for the region.

The cost of crude oil and its distillates added $167.7 million to the total value of imports during 1978, up 13% from that of 1977. The 1979 crude oil and distillates total import cost was about $219.3 million, a 31% cost increase over 1978 on what was estimated to be lower volumes. The projected cost for 1980 petroleum imports was $400 million. The value of petroleum exports in 1980 was estimated at $43 million. Guatemala produces about 13% of its oil requirements.

In 1978 the Government took further steps to encourage petroleum exploration. In January regulations were issued pertaining to the December 1975 revised petroleum law, a model contract was provided as a basis for negotiation, and six northern onshore areas were opened for bidding.

The regulations consisted of 201 articles that set forth definitions and obligations of both the Government and the contractor for the exploration and production of petroleum. The model contract was typical of such documents with most negotiable items left open. At the end of 1979 the Government raised the possibility that all existing oil and mining concession agreements might be renegotiated to increase the State's share of production.

The lateritic nickel mine and processing plant inaugurated in 1977 by Exploraciones y Explotaciones Mineras Izabal S.A. (Exmibal), owned by Inco. Ltd. (80%) and Hanna Mining Co. (20%), fared poorly in the wake of continued adverse nickel markets and shortages of fuel. The plant was closed down for 2 months starting in December 1978 and then again a few months later to allow rebuilding of slag separation facilities. By the end of 1979, Exmibal had increased its development activities.

Barite production should increase sharply when Cía. Minera del Caribe, S.A., and Fluidos de Centroamerica, S.A., bring their mining operations into production in 1980. They and the two other barite companies, Baritas de Guatemala and Tracmasa, will benefit from the increased oil exploration underway.

The shortage of cement continued during 1978 and demand was estimated at about 1,300 tons per day more than domestic production could supply. Legal importation could not cover the shortfall; a situation which worsened when El Salvador, due to its own increased domestic needs, banned export sales of cement to Guatemala. An import agreement was made with Honduras to supply about 7,000 tons of cement per month, some of which was believed to originate in Cuba. In November of 1978, the Government declared cement a matter of national emergency and stipulated that the El Progreso plant would have to sell 40% of its output to State firms at the fixed price of $1.50 per 110-pound bag. Cementos Novella, S.A., increased capacity at the San Miguel plant by 1,600 tons per day.

During 1978-79 the Government offered 8 areas for petroleum exploration. In 1978, bids were accepted for 3 of the 6 areas offered that year. One area went jointly to Texaco Oil Co. and Amoco Oil Co.; one to a consortium led by Getty Oil Co.; and one concession area was granted to Hispanica de Petroleos (Hispanoil) of Spain as operator, with Societe Nacional Elf Aquitaine and Petróleo Brasileiro S.A., as equal partners. Towards the end of 1979 the three untaken areas from the 1978 offering plus two additional areas were opened for bidding. The concessions are located in northern Guatemala where it is hoped that extensions of Mexico's productive southern zone will be found.

Texaco will invest about $20 million for exploration and the drilling of two wells to a depth of at least 12,000 feet. Getty's investment will exceed $19 million for exploration and drilling five wells to a depth of at least 9,000 feet. The Hispanoil group will invest over $12 million for exploration and drilling three wells to a depth of at least 9,000 feet.

Basic Resources International, S.A. (BRISA) purchased the Guatemalan subsidiary of Shenandoah Oil Co. and thus acquired a 100% ownership of the Rubelsanto Field. BRISA also obtained Shenandoah's 30% interest in the West Chinaja and Tortugas areas making their ownership now divided

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between BRISA, 30%, and BEA Petroleum Ltd., 70% (owned jointly by BRISA, 79%, and Elf Aquitaine, 21%).

In late 1979 BRISA completed the 230-kilometer pipeline from the Rubelsanto Field to Puerto Barrios on the Caribbean. Prior to this, oil was hauled by trucks.

Despite sporatic flurries of publicity, the promoters of a Guatemalan transcontinental oil pipeline project have yet to receive Government approval. The pipeline project has been under discussion for several years.

Table 6.—Guatemala: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum metal including alloys:		
Unwrought	36	88
Semimanufactures	278	327
Antimony ore and concentrate	1,525	1,579
Chromite kilograms	--	70
Copper:		
Ore and concentrate	11,122	5,653
Metal including alloys:		
Unwrought	61	67
Semimanufactures	34	63
Iron and steel metal:		
Scrap	166	64
Pig iron, sponge iron, powder	22	1
Spiegeleisen, ferromanganese, other ferroalloys kilograms	227	--
Steel, primary forms do	218	90
Semimanufactures:		
Bars, rods, angles, shapes, sections	1,425	3,749
Universals, plates, sheets:		
Uncoated kilograms	409	40
Coated	428	447
Hoop and strip	11	4
Wire	75	33
Tubes, pipes, fittings	5,824	6,615
Castings and forgings, rough	5	--
Lead metal including alloys:		
Unwrought	5	2
Semimanufactures	33	8
Nickel metal including alloys, semimanufactures kilograms	--	297
Platinum-group metals, ores and concentrates do	--	25
Tin metal including alloys:		
Unwrought do	2,103	92
Semimanufactures	1	6
Zinc:		
Ore and concentrate	160	1,856
Metal including alloys:		
Unwrought	135	109
Semimanufactures	15	8
Other:		
Nonferrous metal scrap kilograms	322	--
Nonferrous base metals do	592	5,528
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	1,338	494
Grinding and polishing wheels and stones	35	20
Asbestos kilograms	136	3,400
Cement	181	37
Clays and clay products:		
Crude:		
Kaolin	5,685	9,670
Other	56	72
Products:		
Refractory	82	64
Nonrefractory	426	647
Diamond, industrial	--	9
Diatomite and other infusorial earth	11	45
Feldspar, fluorspar, cryolite	1,538	1,402
Fertilizer materials:		
Crude	14	667
Manufactured:		
Nitrogenous	3,231	1,159
Phosphatic	790	3,569
Potassic kilograms	--	440
Other, including mixed	126	288
Gypsum and plasters:		
Gypsum	8,395	16,423
Plasters	811	293
Lime	6,775	5,589
Pigments, mineral, natural	1,853	1,002
Precious and semiprecious stones, natural and manufactured	2	1
Salt and brines kilograms	92	--
Sodium and potassium compounds, n.e.s do	--	38

Table 6.—Guatemala: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977
NONMETALS —Continued		
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked:		
Calcareous	4,365	6,500
Other	2	30
Worked	1,068	656
Gravel and crushed rock	44	1,131
Quartz and quartzite	52	1,041
Limestone, except dimension	--	90
Other	811	1,248
Sulfur:		
Elemental kilograms	--	460
Sulfuric acid	7,732	6,102
Talc, steatite soapstone, pyrophyllite	22	17
Other: Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	851	660
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	--	19
Coal, all grades, including briquets	--	3
Coke and semicoke	4	1
Hydrogen, helium, rare gases	54	14
Petroleum refinery products:		
Gasoline 42-gallon barrels	--	2
Kerosine do	--	771
Distillate and residual fuel oils do	1,143	15
Lubricating oils and greases do	461	307
Mineral jelly and wax do	121	481
Other:		
Liquefied petroleum gas do	4,084	3,141
Petroleum asphalt do	101	1,653
Total do	5,910	6,370

Source: Dirección General de Estadistica. Anuario de Comércio Exterior, 1976 and 1977.

Table 7.—Guatemala: Imports of mineral commodities

Commodity	1976	1977
METALS		
Aluminum metal including alloys:		
Unwrought	636	157
Semimanufactures	572	1,223
Copper:		
Ore and concentrate	1,849	2,345
Copper sulfate	24	17
Metal including alloys:		
Unwrought	104	175
Semimanufactures	280	445
Iron and steel metal:		
Scrap	22	5
Pig iron, sponge iron, powder	2	29
Spiegeleisen, ferromanganese, other ferroalloys	167	333
Steel, primary forms	18,508	24,590
Semimanufactures:		
Bars, rods, angles, shapes, sections	23,724	40,417
Universals, plates, sheets:		
Uncoated	47,160	41,776
Coated	14,050	12,061
Hoop and strip	945	753
Rails and accessories	15	831
Wire	10,208	20,068
Tubes, pipes, fittings	4,845	10,201
Castings and forgings, rough	44	176
Lead metal including alloys:		
Unwrought	28	64
Semimanufactures	9	42
Nickel metal including alloys, all forms	7	61
Platinum-group metals including alloys, all forms kilograms	32	2
Silver metal including alloys, all forms do	71	313
Tin metal including alloys:		
Unwrought	22	5
Semimanufactures	8	10

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Table 7.—Guatemala: Imports of mineral commodities —Continued

Commodity	1976	1977
METALS —Continued		
Zinc metal including alloys:		
Unwrought	3,842	3,393
Semimanufactures	21	1
Other:		
Nonferrous metal scrap	95	6
Nonferrous base metals employed in metallurgy, n.e.s	14	135
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	10	21
Grinding and polishing wheels and stones	75	173
Asbestos	2,553	3,297
Boron materials, oxide and acid	16	14
Cement	12,134	37,388
Clays and clay products:		
Crude:		
Kaolin	13,457	6,779
Other	457	584
Products:		
Refractory	8,332	3,962
Nonrefractory	2,409	808
Diamond, industrial kilograms	14	2
Diatomite and other infusorial earth	518	416
Feldspar, fluorspar, cryolite	100	274
Fertilizer materials:		
Crude:		
Nitrogenous	61	100
Phosphatic	--	37
Other	11	32
Manufactured:		
Nitrogenous	97,305	194,427
Phosphatic	12,901	15,601
Potassic	63	8,579
Other, including mixed	33,234	44,557
Graphite, natural	32	24
Gypsum and plasters:		
Gypsum	3	--
Plasters	51	62
Lime	66	627
Mica:		
Crude	59	35
Worked, including agglomerated splittings kilograms	40	1,198
Precious and semiprecious stones, natural and manufactured do	72	18
Salt and brines	18,924	19,440
Sodium and potassium compounds, n.e.s.: Caustic soda	6,992	6,051
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	73	229
Worked	460	317
Gravel and crushed rock	60	932
Quartz and quartzite	493	268
Other	348	438
Sulfur:		
Elemental, all forms	4,296	4,428
Sulfur dioxide	86	125
Sulfuric acid	432	261
Talc, steatite, soapstone, pyrophyllite	325	490
Other: Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	10,901	11,703
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	2	5
Carbon black	871	3,125
Coal, all grades, including briquets	31	95
Coke and semicoke	495	799
Hydrogen, helium, rare gases kilograms	138	174
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	4,452	5,555
Refinery products:		
Gasoline do	994	1,276
Kerosine do	111	148
Distillate and residual fuel oils do	1,031	1,656
Lubricating oils and greases do	98	125
Mineral jelly and wax do	50	85
Other:		
Liquefied petroleum gas do	304	369
Petroleum asphalt do	47	37
Total do	2,635	3,696

Source: Dirección General de Estadística. Anuario de Comércio Exterior, 1976 and 1977.

HONDURAS

In 1978-79 Honduras maintained its real economic growth rate, in terms of 1966 dollars, as one of the highest in Latin America. In 1978, the gross domestic product (GDP) increased 6.3% over that of 1977, and in 1979 it increased 6.7% over that of 1978. The rate of inflation was less than 6% in 1978; but by the end of 1979, after moderate increases for most of the year surged upward during the last quarter, the consumer price index was almost 19% higher than a year earlier. The Government officially estimated the rate of inflation for 1979 as 8.8%.

Honduras has remained dependent on imported oil and, although consumption has been a relatively low 12,000 barrels per day, successive price increases have diverted financial resources from development needs. In 1978 the fuel import cost was $76 million, almost 8% of the total value of imports, and by 1979 its cost had risen to $112 million, or about 11% of total imports. Energy conservation measures, including higher domestic prices, helped curb the growth of petroleum consumption in 1979 to 0.5% over that of 1978 when consumption was 2.5% greater than in 1977.

The El Mochito gold, silver, lead, and zinc mine of Rosario Resources Corp., was the principal mining operation during 1978-79. Increased reserves were obtained from downward and westward extensions of the San Juan orebody. Plant throughput increased to about 1,000 tons per day of ore in 1978 and was expected to be expanded to 2,300 tons per day by 1982. The San Juan sulphide orebody extensions were reported to average 3.8 ounces of silver per ton and contain 3.9% lead, 8.59% zinc, and 0.6% copper.

Canadian Javelin Ltd. planned to open the Moramulca gold-silver mine located in the Department of Choluteca. Mill capacity was expected to be 140 to 180 tons per day of ore.

A study was underway by Altos Hornos de Centro-America S.A. (AHCSA) to determine the feasibility of mining iron deposits near the capial city of Tegucigalpa as feed for a charcoal-fired blast furnace. AHCSA has been involved with a proposed $95 million steel plant at Agalteca. Steel production at the proposed plant was projected at 100,000 tons per year, half of which would be exported.

In 1978 a small iron and steel mill and foundry was the object of a proposed joint venture, Fundiciones Centroamericana, S.A., planned by the U.S. company, Obenchain Corp., and the Honduras Government's investment promotion agency, Corporación Nacional de Inversiones (CONADI). The $5.5 million plant complex would be established near San Pedro Sula and include iron ore reduction cupolas, electric steelmaking furnaces, iron and steel casting and forging, and related ore grinding and pelletization facilities. Ultimate annual capacity was expected to be 75,000 tons of iron and steel with initial output at about 25,000 tons per year.

Products from the Fundiciones project would include steel billets, rods, grinding balls, and forged and cast parts. Iron ore and limestone deposits are located about 10 miles from the projected plant site, although initially iron ore would be imported from Venezuela. As envisioned, the plant design would provide a pilot-scale proving ground for new technology in steelmaking as well as provide Honduras the obvious direct and indirect benefits derived from industrial development. Financing and additional partners were being sought.

In 1979, a new $80 million cement plant was under construction by Industria Cementera Hondureña, S.A., north of Tegucigalpa. Plant capacity was planned at about 360,000 tons per year. In 1979 Honduras purchased cement from Cuba, the first trade with that country in 17 years.

In 1978, 11 companies held onshore or offshore petroleum concessions. Two offshore wells were drilled in 1978 by Esso Standard Oil, S.A.; and Texaco Caribbean, Inc., was scheduled to drill at least one well in 1979. No discoveries were reported.

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Table 8.—Honduras: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	Principal destinations, 1977.
METALS		
Antimony ore and concentrate, gross weight	103	United Kingdom 42; Japan 35; Belgium-Luxembourg 25.
Iron and steel metal including alloys, all forms	1,571	Guatemala 893; Costa Rica 364.
Lead:		
Ore and concentrate, gross weight	35,244	All to United States.
Metal including alloys, all forms	19	All to Guatemala.
Silver:		
Ore and concentrate value, thousands	$11,574	Mainly to United States.
Metal including alloys, all forms thousand troy ounces	50	All to United States.
Zinc:		
Ore and concentrate, gross weight	52,716	United States 31,616; Japan 10,350.
Metal including alloys, all forms	63	West Germany 58.
Other: Ash and residue containing nonferrous metals	26	All to United States.
NONMETALS		
Cement	2,279	Belize 1,296; Guatemala 855.
Clays and clay products (including all refractory brick):		
Crude	22	Mainly to Nicaragua.
Products	74	Guatemala 41; Costa Rica 33.
Fertilizer materials, manufactured, phosphatic	7	All to Guatemala.
Lime, hydraulic	7	Mainly to Nicaragua.
Salt	117	All to Nicaragua.
Stone, dimension, crude and partly worked	20	Do.
Other: Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	68	Spain 35; Nicaragua 24.
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Residual fuel oil thousand 42-gallon barrels	53	Mainly to Trinidad and Tobago.
Lubricants do	(1)	All to Guatemala.

[1] Less than 1/2 unit.

Table 9.—Honduras: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	Principal sources, 1977
METALS		
Aluminum metal including alloys, all forms	1,490	United States 502; Nicaragua 164.
Copper:		
Copper sulfate	67	United States 65; West Germany 2.
Metal including alloys, all forms	200	Mexico 77; United States 56.
Iron and steel metal including alloys, all forms:		
Scrap	1	Mainly from United States.
Other	68,521	Japan 21,369; United States 20,290; Belgium-Luxembourg 5,489.
Lead metal including alloys, all forms	140	Belgium-Luxembourg 50; United States 50; Canada 40.
Nickel metal including alloys, all forms	3	Mainly from United States.
Silver metal including alloys, all forms troy ounces	11,992	Do.
Tin metal including alloys, all forms	48	Denmark 16; United States 13; Peru 10.
Zinc metal including alloys, all forms	824	Mexico 391; Belgium-Luxembourg 216; West Germany 152.
Other:		
Ores and concentrates	28	United States 23; Costa Rica 5.
Metals including alloys, all forms	8	Mainly from United States.
NONMETALS		
Abrasives, natural	98	West Germany 32; United States 32; Italy 10.
Asbestos	1,185	All from Canada.
Cement	1,862	Japan 737; West Germany 635; Belgium-Luxembourg 427.
Clays and clay products (including all refractory brick):		
Crude: Kaolin and other clays or earths	9,644	Guatemala 7,888; United States 1,717.
Products (including nonclay brick)	2,583	United States 1,198; Nicaragua 549.
Diamond, industrial kilograms	12,324	All from United States.
Diatomite and other infusorial earth	409	United States 263; Mexico 112.

Table 9.—Honduras: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	Principal sources, 1977
NONMETALS —Continued		
Fertilizer materials:		
Crude, phosphatic	41	All from United States.
Manufactured	80,043	United States 18,599; West Germany 11,350; Republic of Korea 7,544.
Graphite, natural kilograms	120	United States 104; West Germany 16.
Gypsum and plasters	30	United States 26; West Germany 3.
Lime	1,515	United Kingdom 825; West Germany 675.
Mica, worked kilograms	360	United States 288; Netherlands 41; France 27.
Pigments, mineral, natural, crude do	60	All to Guatemala.
Precious and semiprecious stones, except diamond troy ounces	900	Switzerland 482; United States 354.
Salt	396	United States 384; Canada 12.
Sodium and potassium compounds, n.e.s.:		
Caustic soda	4,342	Nicaragua 3,502; United States 421.
Soda ash	9,648	Romania 7,156; Netherlands 1,407.
Caustic potash	9	United States 7; Colombia 2.
Stone, sand and gravel:		
Dimension stone, all forms	106	Guatemala 75; United States 26.
Other stone	19	All from Guatemala.
Sand, including ground quartz	77	United States 74.
Sulfur:		
Elemental, all forms	23	Mainly from Belgium-Luxembourg.
Sulfuric and sulfurous acids	380	Netherlands 115; United States 113.
Talc and steatite	148	United States 66; China, mainland, 40.
Other:		
Crude	98	West Germany 83; United States 15.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	4,036	Costa Rica 3,115; Nicaragua 540.
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	143	United States 81; Belgium-Luxembourg 60.
Hydrogen	70	United States 61; West Germany 9.
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	3,158	Venezuela 1,923; Trinidad and Tobago 1,201.
Refinery products:		
Gasoline do	126	Trinidad and Tobago 64; Aruba 22; Nicaragua 22.
Kerosine and jet fuel do	50	Nicaragua 26; Panama 10; Trinidad and Tobago 10.
Distillate fuel oil do	387	Trinidad and Tobago 235; Aruba 78; Panama 44.
Residual fuel oil do	39	Aruba 20; Venezuela 19.
Lubricants do	61	United States 43; Jamaica 10.
Other:		
Liquefied petroleum gas do	40	Venezuela 39.
Mineral jelly and wax do	15	Japan 8; United States 3.
Unspecified do	93	Curaçao 63; Nicaragua 29.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	5,420	United States 4,089; Italy 1,079.

NICARAGUA

At the end of 1979 Nicaragua was attempting to resolve an economic crisis arising from about $600 million in service payments due on external debts totaling $1.5 billion. Available monetary reserves, although increasing, remained extremely low and precluded any immediate possibility of even partial payment. The Government was renegotiating the foreign loans to secure a realistic repayment schedule. Although economic vulnerability began several years earlier, problems were primarily caused by inadequate monitoring of loan use, and more recently by strikes, civil insurrection, and fighting which gained intensity during 1978 and finally culminated in the overthrow of the Government in July 1979.

In real terms, the gross domestic product declined by 5.5% in 1978 and by an estimated 25% in 1979. Steps toward restoring domestic and international confidence in Nicaragua's economic prospects were initiated in 1979 and the Government was proceeding with reconstruction planning.

A series of government actions in the latter half of 1979 included the nationalization of the mineral industries. In October it was announced that a national petroleum company, Empresa Nacional del Petróleo, would be established in the near future. The new company would operate under the jurisdiction of the Ministry of Foreign Commerce and assume the responsibility of purchasing all of the petroleum required by the local refinery operated by Esso Standard Oil, S.A., Ltd., which had been purchasing Venezuelan crude oil on a cash basis. As a Government entity, it was anticipated that the new company might be able to negotiate more favorable purchase terms which would ease the drain on available foreign exchange and defer the necessity of increasing the domestic price for refined products.

Pre- and post-revolutionary disruptions of normal economic activities resulted in reduced petroleum consumption. In 1977, Nicaragua imported about 5.4 million barrels of crude oil with a value of $77.9 million. In 1978, imports of crude declined to 3.9 million barrels valued at $57.8 million. It was estimated that in 1979 the volume did not exceed that of the preceding year.

Through Decree No. 112 dated August 24, 1979, the Government established an institute of natural resources and environment, Instituto Nicaraguense de Recursos Naturales y del Ambiente (IRENA). The decree stated that Nicaragua's natural resources were the exclusive patrimony of the nation and that their management and exploitation was the State's exclusive jurisdiction. The State could delegate, when convenient, part of the country's natural resources to corporations and enterprises. IRENA's responsibilities, through its own actions or through its subsidiaries, include the planning, administration, control, and exploration of all natural resources.

A decree dated November 2, 1979, nationalized the Nicaraguan mining industry. Owners of mining companies were to be compensated at book value through bonds earning 6.5% with a 5-year amortization, which included 1 year of grace followed by four equal annual payments. The State reserved the right to claim indemnization for human damage, ecological deterioration, and fiscal evasions that may have resulted from the operations of the mining companies in Nicaragua. The decree also cancelled all rights granted by the previous Government for mineral exploration and exploitation.

The decree created a Nicaraguan Corp. for Mining Development (Codemina) to manage all mineral properties. Codemina will receive advice and coordination from IRENA. Shortly after the decree was issued the mining companies withdrew their foreign personnel from the country. Peru agreed to assist Nicaragua in developing its mining sector and appointed a technical mission for this purpose.

The principal companies affected by nationalization were Rosario Mining of Nicaragua, Inc., a subsidiary of Rosario Resources Corp., which recovered gold and silver from the Risco de Oro, Blag, La Luna, and Siuna mines; Neptune Mining Co., jointly owned by ASARCO, Inc. and Rosario Resources, which mined gold, silver, zinc, lead, and copper from the Vesubio mines at Bonanza; and the Empresa Minera de El Sententrion, majority owned by Noranda Mines, Ltd., which operated the Limón gold mine.

In February 1979, the Government contracted with a Japanese company to build a 35-megawatt geothermal energy plant on the flank of the volcano at Momotombo. This $57 million plant, scheduled for completion in 1981, was the first of three geothermal plants planned for Momotombo to provide a total of 105 megawatts of power at a total estimated cost of $117.5 million. It was anticipated that the project would be completed in 1983. A U.S. company, California Energy Corp., had supervised drilling operations and supposedly was to manage and develop the project.

Exploration activities by the several foreign petroleum companies who hold on- and offshore concessions came to a virtual standstill during 1978-79.

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Table 10.—Nicaragua: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal destinations, 1977
METALS			
Aluminum metal including alloys, all forms	357	1,020	El Salvador 447; Honduras 260; Guatemala 235.
Copper:			
Ore and concentrate	2	489	All to United States.
Metal including alloys, all forms	(1)	(1)	All to Honduras.
Iron and steel metal:			
Scrap	5	158	West Germany 79; Netherlands 60; Spain 18.
Semimanufactures	9,360	8,756	Guatemala 3,810; El Salvador 2,651; Costa Rica 1,513.
Lead:			
Ore and concentrate	1,718	2,318	All to United States.
Metal including alloys, all forms	(1)	2	All to Costa Rica.
Silver metal, worked or partly worked troy ounces	120,179	174,385	Canada 100,696; United States 73,
Zinc ore and concentrate	21,571	19,836	United States 9,129; Belgium-Luxembourg 7,771; Italy 2,936.
Other: Scrap and waste of nonferrous metals	[r]328	361	United States 214; West Germany 143.
NONMETALS			
Asbestos	4	4	All to Honduras.
Cement	--	(1)	All to Costa Rica.
Clays and clay products:			
Crude	133	221	El Salvador 101; Panama 76; Costa Rica 44.
Products:			
Refractory (including nonclay brick)	15	10	Honduras 5; Costa Rica 4.
Nonrefractory	4,357	4,056	Costa Rica 2,035; El Salvador 873; Guatemala 613.
Diatomite and other infusorial earth	1,646	126	Costa Rica 92; Honduras 34.
Feldspar and related materials	467	49	All to Costa Rica.
Fertilizer materials:			
Crude: Nitrogenous	(1)	--	
Manufactured:			
Nitrogenous	1,262	20	All to Honduras.
Other, including mixed	197	3,314	Do.
Gypsum and plasters	14,419	14,966	Costa Rica 14,963; El Salvador 3.
Lime	802	1,077	Costa Rica 1,020; Honduras 57.
Salt	[r]8,414	2,728	All to Costa Rica.
Sodium and potassium compounds, n.e.s	[r]28,042	32,745	Guatemala 10,961; El Salvador 10,864; Costa Rica 6,715.
Stone:			
Dimension, crude and partly worked	339	(1)	All to El Salvador.
Other industrial	40	102	El Salvador 62; Honduras 38.
Quartz	73	76	El Salvador 52; Honduras 15; Guatemala 9.
Sulfuric acid	11	19	All to El Salvador.
Talc and steatite, natural	27	6	Costa Rica 3; United States 3.
MINERAL FUELS AND RELATED MATERIALS			
Hydrogen, helium, rare gases	--	(1)	All to Honduras.
Petroleum refinery products:			
Kerosine 42-gallon barrels	26,203	27,487	Costa Rica 9,224; El Salvador 7,15 Guatemala 6,857.
Lubricants do	129	--	
Other:			
Liquefied petroleum gas do	14,167	4,106	All to Costa Rica.
Paraffin wax do	--	(1)	Do.
Pitch, resin, petroleum asphalt, petroleum coke, and other byproducts of coal and petroleum do	95,688	39,402	Costa Rica 36,477; Honduras 2,8
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,148	899	Guatemala 472; El Salvador 182; Costa Rica 135.

[r] Revised.

[1] Less than 1/2 unit.

Table 11.—Nicaragua: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS			
Aluminum metal including alloys, all forms	1,400	2,228	France 605; United States 582; El Salvador 348.
Copper:			
Copper sulfate	52	76	United States 64; Belgium-Luxembourg 8; West Germany 2.
Metal including alloys, all forms	133	130	United States 57; Mexico 39; West Germany 10.
Chromium: Chromite	(1)	--	
Iron and steel:			
Ore and concentrate	3	3	All from United States.
Metal:			
Scrap	1	6	Costa Rica 4; United States 2.
Ferroalloys	--	55	United Kingdom 46; Costa Rica 9.
Steel, primary forms	5,148	10,352	Republic of South Africa 6,312; Australia 3,119; Mexico 838.
Semimanufactures	57,203	68,566	Japan 31,197; Costa Rica 12,641; United States 8,484.
Lead metal including alloys, all forms	276	271	Mexico 161; United States 94; Guatemala 6.
Nickel metal including alloys, all forms	^{r}1	1	NA.
Silver metal, worked or partly worked troy ounces	4,501	9,549	United States 9,259; United Kingdom 289.
Tin metal including alloys, all forms	20	32	United Kingdom 22; United States 4; Belgium-Luxembourg 3.
Zinc metal including alloys, all forms	194	508	Mexico 240; Canada 190; United States 78.
Other:			
Ores and concentrates of base metals	1	9	Mainly from Costa Rica.
Nonferrous metal scrap	7	--	
Base metals including alloys, all forms	8	76	Japan 70; United States 6.
NONMETALS			
Abrasives, natural, including industrial diamond	220	174	Costa Rica 85; West Germany 29; Guatemala 18.
Asbestos	1,560	1,561	Canada 693; Australia 408; U.S.S.R. 250.
Boron materials: Boric acid	14	8	West Germany 4; France 2; Netherlands 2.
Cement	3,927	7,988	West Germany 6,208; Japan 1,394; United States 335.
Clays and clay products:			
Crude	6,508	4,558	United States 2,791; United Kingdom 1,193; Netherlands 316.
Products:			
Refractory	750	674	United States 570; Costa Rica 48; Mexico 48.
Nonrefractory	365	596	Italy 307; United Kingdom 92; Spain 57.
Diatomite and other infusorial earth	239	1,634	United States 1,509; Mexico 118; West Germany 5.
Feldspar and related materials	1,443	1,301	Guatemala 1,131; United States 141; Honduras 20.
Fertilizer materials:			
Crude	1	1	All from West Germany.
Manufactured:			
Nitrogenous	32,000	73,571	Republic of Korea 24,904; Panama 10,885; Costa Rica 8,892.
Phosphatic	7,750	31,561	United States 23,288; Costa Rica 5,927; Netherlands 1,339.
Potassic	3,592	3,952	United States 2,166; West Germany 989; Costa Rica 688.
Other, including mixed	1,433	9,895	United States 3,288; Costa Rica 2,158; Netherlands 2,042.
Graphite, natural	3	2	All from West Germany.
Gypsum and plasters	408	304	Guatemala 210; United States 60; West Germany 31.
Lime	1,088	3,495	United States 1,809; United Kingdom 1,448; West Germany 220.
Mica, worked, including splittings and waste	1	4	United States 2; West Germany 1.
Pigments, mineral, natural	5	--	
Precious and semiprecious stones, including diamond kilograms	177	178	Guatemala 170; Switzerland 5; United States 3.
Salt	34,181	29,983	Chile 29,700; United States 153; Honduras 108.
Sodium and potassium compounds, n.e.s	^{r}1,679	2,055	United States 1,234; West Germany 475; Netherlands 95.
Stone, sand and gravel	561	1,058	Costa Rica 825; Guatemala 80; United States 59.

See footnotes at end of table.

Table 11.—Nicaragua: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
NONMETALS —Continued			
Sulfur:			
Elemental	296	443	West Germany 255; Belgium-Luxembourg 185.
Sulfuric acid	726	808	El Salvador 801; United States 4; West Germany 3.
Talc	378	327	United States 306; China, mainland, 20.
Other, crude	99	51	Mainly from United States.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	12	4	All from West Germany.
Coal and coke	51	69	United States 38; West Germany 30.
Hydrogen, helium, rare gases	1	59	Mexico 55; United States 4.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	4,258	5,414	Mainly from Venezuela.
Refinery products:			
Gasoline do	127	147	Netherlands Antilles 124; Panama 11; United States 5.
Kerosine do	17	42	Netherlands Antilles 27; United States 10; Panama 3.
Distillate fuel oil do	[r]174	770	Venezuela 416; Panama 146; Netherlands Antilles 139.
Lubricants do	73	66	United States 28; Jamaica 15; Netherlands Antilles 10.
Other:			
Liquefied petroleum gas do	[r]1	3	Mainly from United States.
Mineral jelly and wax do	10	18	Japan 7; West Germany 4; United States 3.
Pitch, resin, petroleum asphalt, petroleum coke, and other byproducts of coal and petroleum do	1	2	United States 1.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	5,759	28,048	Netherlands Antilles 25,592; United States 2,110.

[r] Revised. NA Not available.
[1] Less than 1/2 unit.

PANAMA

The gross domestic product (GDP) continued to benefit from the stimulus provided by the signing, ratification, and implementation of the Panama Canal Treaty. Real growth in the GDP registered 2.7% in 1978 and in 1979 was estimated at 4.5%, the highest rate since the early 1970's. Panama's rate of inflation was 4.2% in 1978 and about 7.5% in 1979, among the lowest in all Latin America.

The balance of trade deficit increased during 1978-79 as an expanding road system and growing air traffic added to oil import costs. Refined petroleum continued to be the country's biggest export earner. Petroleum refining accounted for about 25% of export earnings. The nonfuel minerals sector has had a negligible effect on the economy.

Development of the proposed $2 billion Cerro Colorado copper complex has been delayed because of questions regarding economic viability at the current market price for copper and assured adequate financing. In 1978 the Canadian Export Development Corp. announced its agreeement in principle to lend $1.1 billion for the project.

Towards the end of 1979 the Government announced that it would reduce its 80% equity in the project by as much as 20% or 30%. Texasgulf, Inc., appeared to be unwilling to increase its 20% equity in the venture. Texasgulf reported it would assist in finding other equity participation or, if convenient to Panama, would withdraw from participation in favor of a company willing to assume a 40% equity. The Government claimed that several companies had expressed interest in the project.

In 1978, Cobre Panama, S.A., a Japanese consortium composed of Mitsui Mining and Smelting Co. Ltd., Mitsubishi Metal Corp., and Dowa Mining Co. Ltd., began negotiations with the Government for development of the Petaquilla copper deposits. It was reported that reserves amount to about 300 million tons of ore averaging 0.7% copper. Costs for the project to produce copper concentrate were placed at about $250 million for a 20,000-ton-per-day ore mining facility. Negotiations were expected to continue for an extended period of time.

In 1978, Earth Resources International was reported to be operating manganese properties in a joint venture agreement with Merimax, S.A. The concession is located in the Distrito de Portobelo. In 1978 work was progressing on road construction and a docking area at Bahía de San Cristóbal. No further information has been made available.

Petroleum exploration has not yet resulted in any reported commercial discoveries. In 1978, Texaco Inc., through its subsidiaries Carib Exploration S.A., San Blas Exploration, S.A., Colon Exploration S.A., Balboa Exploration S.A., and Isthmus Exploration S.A., was awarded an additional 9,500 square miles of offshore concessions. In 1979 Texaco drilled unsuccessfully on the offshore concession held jointly with Amerada Hess Corp. Sossa Petroleum and Tacoma Resources were also unsuccessful in their joint drilling effort.

In April 1979, the Puerto Armuelles onshore terminal for the transshipment of Alaskan crude oil through the Panama Canal began operations. Petroterminal de Panama, S.A. (PTP) is jointly owned by the Panama economic development agency, Corporacion Financiera Nacional (25%), and a group headed by Northville Industries Corp. (60%), within which Telepsen Wallace of Houston, the construction contractor, and Chicago Bridge and Iron each hold a 7.5% interest.

The cost of the terminal was estimated at about $58 million, about $11 million more than the 1977 preconstruction estimate. The terminal, managed by Northville, can accommodate 550,000 to 600,000 barrels of oil per day. The terminal has three berths, three storage tanks, ballast and fresh water systems, and fire protection equipment. An access trestle to shore is connected to two of the jetties while the third birth is connected to shore by two 36-inch pipelines. The three berths can service tankers of 265,000 tons, 90,000 tons, and 60,000 tons, respectively, with 30,000 tons being the minimum size tanker for all three.

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[1] Physical scientist, Branch of Foreign Data.

Table 12.—Panama: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	Principal sources, 1977
METALS		
Aluminum metal including alloys, all forms	1,526	United States 831; France 214.
Copper metal including alloys, all forms	318	Chile 219; Mexico 45; United States 41.
Iron and steel semimanufactures:		
Bars, rods, angles, shapes, sections	11,871	United States 5,895; Taiwan 2,644; Sweden 1,355.
Universals, plates, sheets	8,390	Japan 7,390.
Hoop and strip	18,029	Japan 6,875; Canada 3,801; Netherlands 1,621.
Rails and accessories	348	Sweden 322.
Wire	4,114	Japan 1,960; United States 618; Brazil 493.
Tubes, pipes, fittings	6,236	Sweden 2,500; Japan 1,598; Costa Rica 1,237.
Castings and forgings, rough	3,121	Costa Rica 2,848.
Lead metal including alloys, all forms	547	Mexico 535.
Platinum-group and silver metals including alloys:		
Platinum-group troy ounces	1,247	United States 448; Spain 290.
Silver do.	180	United States 83; Hong Kong 47.
Zinc metal including alloys, all forms	409	United States 233; West Germany 72.
NONMETALS		
Asbestos	532	Canada 531.
Cement	3,561	Japan 2,660.
Clays and clay products (including all refractory brick):		
Crude	1,094	United States 752.
Products, refractory (including nonclay brick)	799	United States 796.
Fertilizer materials, manufactured:		
Nitrogenous	15,583	Costa Rica 5,304; West Germany 3,000.
Phosphatic	10,855	United States 10,708.
Potassic	1,063	United States 1,038.

Table 12.—Panama: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	Principal sources, 1977
NONMETALS —Continued		
Fertilizer materials, manufactured —Continued		
Other, including mixed	40,091	Costa Rica 27,710; Netherlands 6,642.
Lime	1,169	United Kingdom 500; United States 304.
Precious and semiprecious stones, except diamond value, thousands	$1,942	United States $655.
Salt	725	Netherlands 265; United Kingdom 229.
Sodium and potassium compounds, n.e.s.:		
Caustic soda	2,040	United States 1,333.
Other	5,194	Mexico 1,563; Netherlands 1,072; United States 944.
Stone, sand and gravel	2,433	Costa Rica 1,084.
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	67,932	Ecuador 32,187; Venezuela 16,936; Saudi Arabia 16,028.
Refinery products:		
Gasoline do	182	Trinidad and Tobago 100; Venezuela 82.
Distillate fuel oil do	980	Venezuela 619; Trinidad and Tobago 359.
Residual fuel oil do	75	Curaçao 47; United States 22.
Lubricants do	222	United States 117; Curaçao 56; Jamaica 38.
Mineral jelly and wax do	14,370	Japan 8,463; United States 3,905.
Other do	4,480	United States 3,780; United Kingdom 700.
Total do	20,309	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	738	United States 545; Jamaica 167.

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The Mineral Industry of Other Areas of the Far East and South Asia

By Staff, Branch of Foreign Data

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BANGLADESH[1]

The only economically important mineral currently produced in Bangladesh was natural gas. Bangladesh was not a world-ranked producer of any mineral commodity, but the possibility of producing and exporting commercial amounts of liquefied natural gas (LNG) was being examined. Proved reserves of natural gas were sufficient to supply most of the country's industrial and domestic heating and electric needs and still support an export-oriented LNG plant. Other mineral production was of virtually no significance to the economy, although there were a few prospects for nonmetallic mineral development.

Bangladesh continued to make economic progress during 1978 and into early 1979. Gross domestic product (GDP) at current prices rose from $6.6 billion in 1976-77[2] to $8.2 billion in 1977-78 and $9.3 billion in 1978-79.[3] In fiscal 1979, the economic conditions were favorable until a severe drought hit most of the country. It was reported that conditions were the worst in 40 years, and as of July 1979, substantial crop losses were predicted. The agricultural sector accounts for over 53% of the GDP and about 75% of all employment. The poor weather will cause economic problems in the form of slower growth, larger trade deficits, and a higher rate of inflation. The 1978-79 statistics showed that real GDP increased just 4%.

Population growth of about 2.8% per year continued to be a major problem for the country. The population was approaching

88 million by yearend 1979, and approximately 50% of the total had not reached their 18th birthday. Overall rural population density remained one of the highest in the world.

The Government's policy was to encourage new industry in the less developed and nonmetropolitan areas. Government incentives included liberal tax holidays, permission to bring in management teams and supervisors, and a "one stop" investment coordinating office to cut red tape. Since 1975, the country has moved slowly to resurrect previously nationalized private enterprise. Local businessmen have begun limited investment, and foreign capital has been trickling in. More than 100 industries have reportedly been denationalized and about 500 small shops and factories turned over to the private sector. Despite these changes, more than 80% of the industrial assets still remain under Government ownership. In addition to utilities, the Government has reserved basic jute, textile, and sugar processing and manufacturing as public industries. Specialized jute and textile operations, however, have been opened to the private sector.[4] In FY 1977-78, foreign investments worth $17 million were approved and actual money invested totaled $11.8 million. The primary areas of foreign investor interest included deep-sea fishing, shrimp culture, leather, garment making, food processing and pharmaceuticals. Foreign investment in Bangladesh has some disadvantages. The investor must cope with a poorly developed transportation and communications network, a limited domestic demand, an unskilled labor force, and an often stifling bureaucracy.

Power generation and distribution is wholly inadequate. Installed generating capacity is only 752 megawatts; total generation in FY 1978 was 1,912 million kilowatt-hours, 22 kilowatt-hours per capita. In comparison, Thailand used about 250 kilowatt-hours per capita and the United States 9,400 kilowatt-hours per capita. New generation facilities totaling 125 megawatts were planned. Distribution was being improved under a rural electrification plan.

The inflation rate, stimulated by shortages of crucial raw materials, by devaluations of the taka, and by a large increase in the money supply, rose to 15% during 1978-79. The cost of living indices also begin to rise rapidly during the fourth quarter of 1978-79 in response to high open market food grain prices and increase in the prices of certain subsidized products. The Dacca middle-class cost-of-living index rose over 14% between June 1978 and June 1979, and 9.7% alone in the last quarter of FY 1979.

Exports rose to $497 million in FY 1977-78 and then totaled $602 million in FY 1978-79. The sale of minerals was an insignificant part of the export market in 1978 and 1979. Jute, tea, and leather accounted for nearly all of the export value.[5]

Imports totaled $1,274 million during 1977-78 and increased to $1,572 million in 1978-79. The major import items were raw materials, industrial goods, and food grains. Because of the sharp increase in imports, the balance-of-trade deficit more than doubled from 1976-77 through 1978-79 and stood at nearly $1 billion at fiscal yearend.

COMMODITY REVIEW

Bangladesh's proved natural gas reserves were placed at over 250 billion cubic meters in 1979, greater than Asian producers like Afghanistan, Brunei, and India. Output, however, was very low compared with potential production. In an effort to increase production and decrease petroleum imports, several nations either signed agreements or were negotiating with Bangladesh in 1979 to help in the development of its gas reserves. The Asian Development Bank advanced an additional $25 million for the gas-based fertilizer plant under construction at Ashuganj. The United Kingdom was to provide funding to help boost output at the Titas Gasfield. The Titas Field is to supply the Ashuganj plant with feedstock. Output will reportedly be tripled as a result of the improvements.

Other plans call for construction of a [illegible]-kilometer-long, 60-centimeter-diameter pipeline from the Bakhrabad gas discovery to the Chittagong area. Various industries would switch to natural gas from oil, or be established to use natural gas as their energy source and/or raw material. The World Bank, which was asked to finance the project, has questioned the initial cost and advised a smaller size pipeline be constructed. Earlier tentative plans for an export-oriented liquefied natural gas plant had been postponed because of the high cost and current lack of an assured market.

Bangladesh's first liquefied petroleum gas (LPG) plant was inaugurated in July 19[illegible] at the Eastern Refinery, Ltd., in Patenga, Chittagong. The plant will produce about 6,000 tons per year of LPG from refinery waste gas which was formerly flared. The LPG will be used for domestic fuel in place of imported kerosine.[6]

The vigorous offshore oil exploration program has yielded no commercial oil discoveries and only one gas strike. Several of the foreign drilling companies which held production sharing contracts with the Government withdrew from further drilling during 1977 and 1978. No offshore drilling was reported during the first half of 1979.

Bangladesh imports all of its petroleum needs, mostly as crude oil and diesel fuel, but with supplemental amounts of other refined products as well. There were shortages of diesel fuel in March 1979 because of the changes in Iran, Bangladesh's major supplier in past years. Several other countries, however, helped to supply the shortfall and no severe problems were reported. The Government was making arrangements to import petroleum from a number of different suppliers in coming years.

Except for natural gas production, the mineral industry contributed virtually nothing to the overall economy in 1978 and 1979. Some mineral projects were, however, in the planning stage and while insignificant by world standards, could mean a great deal to the local economy.

Bangladesh's construction sector is a potentially large market for hard rock building stone and aggregate, perenially in short supply because of the river delta setting of most of the country. The Government proposed to develop the large Ranipukur granite gneiss deposit at Madhyapara in the northwest. The deposit is deeply buried beneath the surface. The Saudi Development Fund will reportedly provide the $32 million needed to construct the underground mine. The State-owned Bangladesh Mining Corp. will undertake the 1.7-million-ton-per-year project. The mine will provide direct employment for 600 men and indirectly another 1,800 workers. Construction of the project was to start in February 1979 and be operational by yearend 1981. However, building of the requisite infrastructure may double the cost and delay the starting time of the project.[7]

Another plan by the Government was the development of the cement industry. The plan envisioned a limestone mine and clinker production plant being set up at Jaipurhat in Bogra District. The deposit, containing about 100 million tons of cement-grade limestone, lies at a depth of more than 500 meters. The mine will be designed to supply 5,500 tons per day of limestone. Estimated cost of the limestone project will be over 100 million dollars. Bangladesh currently needs about 308,000 tons of limestone annually for cement factories and other uses. Of the total needs, 60,000 tons of limestone are produced by the existing Takerghat limestone mine and the balance is imported from India. The new mine will meet the country's current demand as well as that of the planned cement factory.

A large cement plant will be built at Jaipurhat and will ultimately produce 3,000 tons per day of clinker. The first stage construction will supply 1,000 tons per day of clinker to an existing plant at Chittagong that presently imports clinker, and 1,000 tons per day to a planned grinding plant at Khulna. The final stage will be to put in a clinker grinding section at Jaipurhat and bring the plant to the final 3,000 tons per day capacity. Cost of the cement project was estimated at $120 million. Foreign credit had not been secured for the project at yearend 1979.[8]

Bangladesh imports cement from countries such as North Korea and Indonesia since demand generally exceeds the local production capacity.

The Government was considering the establishment of a 500,000-ton-per-year direct-reduction-based steelworks. The plant would use imported ore but domestic natural gas as reductant and fuel.

The Bangladesh Atomic Energy Commission has been conducting geologic exploration for uranium in the hills of Sylhet and the placer sands off Chittagong. Reportedly, mineral deposits containing both thorium and uranium were confirmed in early 1978 after more than one year of work.

Construction continued during 1978 and 1979 on a large and increasingly expensive nitrogen fertilizer plant at Ashuganj. The plant is scheduled for completion in late 1980 and will significantly reduce Bangladesh's need to import nitrogenous fertilizer. Rapidly rising costs during the construction period, however, caused problems and the need for additional financing from the Asian Development Bank. The 1,600-ton-per-day-urea plant was originally estimated to cost $250 million but will probably exceed $430 million before it goes into production. Despite the increased cost, the project was considered to be economically and financially sound. The Government has emphasized that it has accorded the highest priority to the completion of the plant, which is needed to help the country achieve self-sufficiency in food production and increase agricultural production for export.

Table 1.—Other Areas of the Far East and South Asia: Production of mineral commodities

Area, commodity, and unit of measure	1976	1977	1978[p]	1979[e]
BANGLADESH[1]				
Cement, hydraulic[2] ... metric tons	[r]157,000	307,600	341,000	[illegible]
Clays: Kaolin ... do.	1,575	[2][4]4,211	[3]6,524	[illegible]
Gas, natural, marketed[3] ... million cubic feet	31,344	32,026	34,294	[illegible]
Iron and steel:[3]				
Crude steel (ingots only) ... metric tons	82,227	116,259	124,879	[illegible]
Mild steel products ... do.	[r]74,523	96,500	145,811	[illegible]
Nitrogen, N content of ammonia ... do.	147,700	107,100	105,100	[illegible]
Petroleum refinery products:				
Gasoline ... thousand 42-gallon barrels	468	491	523	[illegible]
Jet fuel ... do.	166	60	55	[illegible]
Kerosine ... do.	1,985	2,021	2,289	[illegible]
Distillate fuel oil ... do.	1,306	1,317	746	[illegible]
Residual fuel oil ... do.	3,000	3,031	2,742	[illegible]
Lubricants ... do.	207	209	--	--
Other:				
Naphtha ... do.	831	832	1,174	[illegible]
Unspecified ... do.	9			
Refinery fuel and losses ... do.	458	375	278	[illegible]
Total ... do.	8,430	8,336	7,807	[illegible]
Salt, marine[3] ... metric tons	[r]549,500	345,600	785,517	[illegible]
Stone: Limestone, industrial ... do.	60,800	56,300	[e]62,000	[illegible]
BRUNEI[1]				
Gas, natural:				
Gross ... million cubic feet	341,343	346,011	[e]342,000	[illegible]
Marketed ... do.	298,829	314,253	307,600	[illegible]
Natural gas liquids:				
Condensate ... thousand 42-gallon barrels	4,031	3,062	[e]2,900	[illegible]
Natural gasoline ... do.	573	816	890	[illegible]
Liquefied petroleum gas ... do.	144	166	175	[illegible]
Total ... do.	4,748	4,044	[e]3,965	[illegible]
Petroleum:				
Crude ... do.	74,424	76,650	76,535	[illegible]
Refinery products:				
Gasoline ... do.	153	141	141	[illegible]
Distillate fuel oil ... do.	209	219	219	[illegible]
Residual fuel oil ... do.	1	1	1	[illegible]
Other ... do.	32	32	32	[illegible]
Refinery fuel and losses ... do.	1	1	1	[illegible]
Total ... do.	396	394	394	[illegible]
CHRISTMAS ISLAND[1]				
Phosphate rock ... thousand metric tons	1,033	1,186	1,400	[illegible]
HONG KONG[1]				
Cement, hydraulic ... do.	765	1,029	1,238	[illegible]
Clays: Kaolin ... metric tons	1,306	2,466	2,700	[illegible]
Feldspar ... do.	2,299	3,378	3,157	[illegible]
Iron and steel:				
Iron ore and concentrate ... do.	37,058	--	--	[illegible]
Crude steel ... do.	72,000	75,000	75,000	[illegible]
Quartz ... do.	982	2,063	665	[illegible]
Tellurium, refined ... kilograms	--	--	NA	[illegible]
KAMPUCHEA[e] [1]				
Cement, hydraulic ... metric tons	50,000	50,000	10,000	--
Gold, mine output, metal content ... troy ounces	1,000	1,000	--	[illegible]
Salt ... metric tons	30,000	30,000	12,000	[illegible]
LAOS[1]				
Salt, rock[e] ... do.	10,000	10,000	15,000	[illegible]
Tin, mine output, metal content ... do.	[e]576	[e]600	400	[illegible]
MONGOLIA[1] [6]				
Cement, hydraulic ... thousand metric tons	[e]160	[e]160	100	[illegible]
Coal:				
Anthracite and bituminous ... do.	205	[e]240	250	[illegible]
Lignite and brown ... do.	2,716	3,078	3,150	[illegible]
Total ... do.	2,921	3,318	3,400	[illegible]

See footnotes at end of table.

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Table 1.—Other Areas of the Far East and South Asia: Production of mineral commodities —Continued

Area, commodity, and unit of measure	1976	1977	1978[p]	1979[e]
MONGOLIA[1] [4] —Continued				
Copper, mine output, metal content[e] metric tons	--	--	4,000	4,000
Fluorspar, all grades[e] thousand metric tons	302	320	335	250
Gypsum[e] do.	25	28	28	28
Lime, hydrated, and quicklime[e] do.	40	50	50	50
Petroleum refinery products:[e]				
Kerosine thousand 42-gallon barrels	16	NA	NA	NA
Residual fuel oil do.	13	NA	NA	NA
Salt[e] metric tons	11,000	15,000	15,000	15,000
NEPAL				
Beryllium: Beryl, industrial-grade (10%-12% BeO) kilograms	[e]1,000	777	320	[3]120
Cement, hydraulic metric tons	29,565	42,036	35,850	[3]21,364
Clay for cement do.	NA	NA	3,000	[3]4,000
Coal: Lignite do.	1,824	1,956	1,700	[3]37,530
Copper ore:				
Gross weight do.	5	6	[e]35	--
Cu content do.	[e]1	[e]1	7	--
Gem stones:				
Beryl kilograms	NA	5	2	--
Garnet do.	25,000	29,600	12,000	[3]4,000
Tourmaline do.	50	75	50	[3]25
Lime, agricultural metric tons	NA	NA	NA	[3]10,054
Salt do.	6	NA	7	[3]7
Stone:				
Limestone do.	[e]50,000	54,391	50,000	[3]62,400
Marble:				
Chips do.	NA	67	131	[3]66
Cut square meters	1,670	761	1,370	[3]863
Craggy do.	3,910	NA	2,320	[3]799
Talc metric tons	52	77	510	--
SINGAPORE[1]				
Cement, hydraulic[e] thousand metric tons	1,350	1,350	1,350	1,350
Iron and steel: Crude steel do.	[r]203	206	280	[3]297
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	11,985	13,152	10,679	11,000
Jet fuel do.	24,022	21,194	35,970	36,000
Kerosine do.	10,244	21,173	18,094	18,000
Distillate fuel oil do.	43,479	51,189	59,775	60,000
Residual fuel oil do.	52,341	69,436	78,424	79,000
Lubricants do.	3,001	3,278	3,964	4,000
Other do.	21,896	28,110	33,131	34,000
Refinery fuel and losses do.	5,635	9,086	9,953	10,000
Total do.	172,603	216,618	249,990	252,000
Stone: Granite, broken thousand cubic meters	2,524	2,572	2,235	2,500
Sulfur, byproduct of oil refining metric tons	[e]7,000	23,043	25,000	25,000
SRI LANKA				
Cement, hydraulic thousand metric tons	426	356	575	680
Clays:				
Ball clay metric tons	796	1,590	2,309	2,000
Kaolin do.	4,360	5,182	5,541	5,440
Brick and tile clay do.	51,014	132,621	86,000	90,000
Clay for cement do.	57,307	34,617	103,232	70,000
Feldspar, crude and ground do.	3,199	3,679	3,160	3,180
Gem stones, precious and semiprecious, except diamond value, thousands	$33,946	$28,828	$33,718	$30,000
Graphite, all grades metric tons	8,290	8,875	10,506	10,900
Iron and steel semimanufactures do.	28,295	[e]28,000	[e]30,000	30,000
Mica scrap do.	137	[e]100	140	136
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	846	858	1,098	1,100
Jet fuel do.	615	580	276	300
Kerosine do.	1,460	1,423	1,632	1,700
Distillate fuel oil do.	2,719	2,722	2,681	2,700
Residual fuel oil do.	3,421	3,608	3,646	3,700
Other do.	1,095	1,071	1,069	1,100
Refinery fuel and losses do.	664	651	390	400
Total do.	10,820	10,913	10,792	11,000
Rare-earth metals: Monazite concentrate, gross weight metric tons	1	[e]5	200	200
Salt do.	140,504	51,923	149,825	154,000
Sand and gravel: Glass sand do.	1,240	NA	[e]1,500	1,500
Stone:				
Limestone thousand metric tons	647	566	975	1,000
Quartz, massive metric tons	838	768	893	800

See footnotes at end of table.

Table 1.—Other Areas of the Far East and South Asia: Production of mineral commodities —Continued

Area, commodity, and unit of measure	1976	1977	1978[p]	1979[p]
SRI LANKA —Continued				
Titanium concentrates, gross weight:				
Ilmenite .... metric tons	55,814	34,092	33,041	[illegible]
Rutile .... do	1,039	978	11,497	[illegible]
Zirconium: Zircon concentrate, gross weight .... do	10	[e]10	3,297	[illegible]
VIETNAM[e] [7]				
Cement, hydraulic .... thousand metric tons	[r]740	[r]820	850	[illegible]
Chromite .... metric tons	9,000	[r]10,000	12,000	[illegible]
Clays: Kaolin .... do	1,000	1,000	1,100	[illegible]
Coal: Anthracite .... thousand metric tons	5,000	[r]6,100	6,200	[illegible]
Gypsum .... metric tons	10,000	12,000	13,600	[illegible]
Iron and steel:				
Primary, ingot .... thousand metric tons	200	200	200	[illegible]
Semimanufactures, rolled .... do	20	[r]40	50	[illegible]
Nitrogen, N content of ammonia .... metric tons	---	10,000	20,000	[illegible]
Phosphate rock .... do	1,500	1,500	1,800	[illegible]
Salt .... thousand metric tons	350	375	375	[illegible]
Tin:				
Mine output .... metric tons	250	250	250	[illegible]
Metal, smelter .... do	200	200	200	[illegible]
Zinc:				
Mine output, metal content .... do	10,000	10,000	8,000	[illegible]
Metal, smelter, primary .... do	[r]9,000	[r]9,000	7,200	[illegible]

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities listed, other crude construction materials such as sand and gravel and other varieties of stone presumably are produced, but available general information is inadequate to make reliable estimates of output levels.

[2] Data are for years ending June 30 of that stated.

[3] Reported figure.

[4] May include other clays.

[5] Gross production is not reported; the quantity vented, flared, or reinjected is believed to be negligible.

[6] In addition to the commodities listed in the body and footnote 1, molybdenum production was initiated in Octo 1978, but output is not reported and no basis is available for reliable estimates of output levels.

[7] In addition to the commodities listed, iron ore was mined in the past and pig iron and crude steel were produced at industrial facilities, but the status of these industries under prevailing conditions is not sufficiently clear to allow formulation of reliable estimates of output levels. Similarly, data on output of crude construction materials are not available and no reliable basis for estimation is available.

Table 2.—Bangladesh: Exports of mineral commodities[1]

(Thousand U.S. dollars unless otherwise specified)

Commodity	1976	1977
Abrasives, natural	([2])	1
Cement	([2])	1
Fertilizers, natural .... metric tons	25	---
Petroleum refinery products:		
Gasoline	372	[illegible]
Kerosine	11	---
White spirit	19	[illegible]
Distillate fuel oil	4,149	[illegible]
Lubricants	2,107	[illegible]
Other	---	[illegible]

[1] Data are for the fiscal year, which is the year beginning July 1 of that stated.

[2] Less than 1/2 unit.

Table 3.—Bangladesh: Imports of mineral commodities[1]

(Thousand U.S. dollars unless otherwise specified)

Commodity	1976	1977
METALS		
Aluminum:		
Oxides and hydroxides .... metric tons	259	[illegible]
Metal including alloys, all forms	3,568	[illegible]
Copper metal including alloys, all forms	2,481	[illegible]
Iron and steel:		
Oxides .... metric tons	231	[illegible]

See footnotes at end of table.

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Table 3.—Bangladesh: Imports of mineral commodities[1] —Continued

(Thousand U.S. dollars unless otherwise specified)

Commodity	1976	1977
METALS —Continued		
Iron and steel —Continued		
Metal:		
Scrap metric tons	14	18,006
Pig iron, including cast iron	9,612	--
Sponge iron, powder, shot	22	10,321
Ferroalloys and similar materials	79	273
Steel, primary forms	4,473	7,701
Semimanufactures:		
Bars, rods, angles, shapes	984	1,154
Universals, plates, sheets	12,729	22,493
Hoop and strip	1,093	1,312
Rails and accessories	1,226	591
Wire	985	1,865
Tubes, pipes, fittings	3,428	5,707
Castings and forgings, rough	225	42
Total	20,670	33,164
Lead:		
Oxide metric tons	92	100
Metal including alloys, all forms	446	58
Manganese ore and concentrate	8	--
Nickel metal including alloys, all forms	115	110
Tin metal including alloys, all forms	197	392
Tungsten, molybdenum, tantalum	52	35
Zinc metal including alloys, all forms	1,158	1,016
Other:		
Nonferrous ores and concentrates	15	2
Base metals	29	1
NONMETALS		
Abrasives, natural:		
Grinding and polishing wheels and stones	111	106
Other	14	123
Cement[2]	15,008	23,815
Clays and clay products (including all refractory brick):		
Crude	318	487
Products:		
Refractory (including nonclay brick)	2,424	7,212
Nonrefractory	1,176	710
Fertilizer materials:		
Crude:		
Nitrogenous	5	--
Phosphatic	2,144	3,070
Manufactured:		
Nitrogenous	4,619	12,887
Phosphatic	783	6,713
Potassic	1,472	70
Gypsum and plasters	67	21
Salt	1,398	8,329
Sodium and potassium compounds, n.e.s.:		
Caustic soda metric tons	3,890	6,670
Soda ash do	8,993	6,317
Other do	1,163	1,969
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	992	268
Worked	86	76
Gravel and crushed rock	279	229
Sulfur	1,115	61
Other: Building materials of asbestos and fiber cement	664	738
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural metric tons	32,886	44,388
Coal, all grades, including briquets do	266,635	269,071
Coke and semicoke	2,380	--
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	14,193	5,746
Refinery products:		
Gasoline	53,594	106,429
Kerosine	34,195	35,496
White spirit	663	797
Distillate fuel oil	885	5,018
Lubricants	7,957	8,284
Mineral jelly and wax	1,449	1,883
Pitch coke	186	298
Bitumen and other residues	6,951	9,859
Total	105,880	170,064
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,262	1,204

[1] Data are for the fiscal year, which is the year begining July 1 of that stated.

[2] Figures include 338,192 metric tons valued at $14,360,780 in 1976-77 and 393,860 metric tons valued at $23,767,315 in 1977-78.

BRUNEI[9]

Brunei, a small country on the northwest coast of Kalimantan island (formerly called Borneo), was one of the world's largest exporters of liquefied natural gas (LNG). It was also an important South Asian exporter of crude oil in 1978 and 1979. Brunei's economy was almost totally dependent on oil and natural gas.

In both 1978 and 1979, as in the past few years, Brunei was one of the few nations in the world having a very significant budget surplus, estimated to be about $600 million in 1978,[10] resulting in a balance in the consolidated revenue fund of $2.8 billion for a nation of fewer than 200,000 population. The projected surplus by the end of 1979 was to reach about $3.4 billion.

Neither oil nor natural gas production in 1979 was expected to vary a great deal from the output levels in 1978. Natural gas sales in particular were virtually fixed by the capacity of the liquefaction plant at Lumut which has run at designed capacity since completion in mid-1976. The gross national product (GNP) for 1979 will be closely tied to the price obtained for exported crude oil and LNG. The Government reportedly earned about $960 million in 1978, and earnings were projected at around $1,022 million for 1979.[11] Government earnings were derived mainly from dividends, taxes, and royalties from the production of oil and natural gas. A small income also came from the sale of timber and natural rubber.

Recurring Government expenditures were approximately $385 million in 1978, approximately $420-$450 million was to be spent during 1979. By far the largest expense was for the upkeep and improvement of the Royal Brunei Military Regiment.

Spending for development projects was to take about $90 million during 1978, but owing to slow deliveries and optimistic building schedules, only $46 million was actually used on new Government construction projects.

On January 7, 1979, Brunei and the United Kingdom signed a treaty that will grant Brunei full political independence at the end of 1983. It replaced the treaties of 1959 and 1971 that gave the Sultanate self-government but allowed the United Kingdom responsibility over its external defense and foreign relations.

In order of value, the major exports from Brunei were crude oil, 62%; LNG, 32%; and refined petroleum products, 4%. The major imports were consumer goods, plant and capital equipment, raw materials, and food.

COMMODITY REVIEW

Petroleum and Natural Gas.—Crude oil production was from the Seria, Ampa SW, Fairley, and the Champion Oilfields. Output by the Champion Oilfield, discovered in 1970, rose significantly to more than offset the decline in production of the older fields. Brunei Shell Petroleum Co. (Brunei Shell) continued development drilling in offshore oilfields and stepped up exploration activities. Seven drilling rigs were reportedly active during 1978 and 1979 and the small new offshore Tali Oilfield was being developed for production.

Current output level was in the range from 210,000 to 225,000 barrels per day of crude oil. Natural gas production remained roughly constant at about 775 million cubic feet per day, the amount needed by the Lumut LNG plant to fill its contractual obligation with Japan. The plant supplies over 5 million tons per year via LNG tankers.

Exploration for new deposits will be conducted to maintain the current production level. The old Seria Oilfield, which has furnished over 900 million barrels of crude oil since 1928, was expected to begin to taper off in coming years.

CHRISTMAS ISLAND[12]

Phosphate rock and dust was the only mineral commodity produced commercially on the Island during 1978 and 1979. Christmas Island, located 2,600 kilometers northwest of Perth, Australia, and 300 kilometers south of Java, produced over 28 million tons of phosphate rock between the initiation of mining in 1900 and yearend 1979.

Mining was controlled by the British Phosphate Commission, which has shareholders from United Kingdom, Australia, and New Zealand. A strike by mine workers in 1979 brought exports to a stop in June. Although the problems were not completely resolved, work resumed by early July and exports for that month were 120,000 tons. An Australian government commission was appointed to report on the problems and the overall phosphate operation.

Australia and New Zealand are the main importers of the Island's phosphate rock. However, Malaysia began buying a Grade B rock in 1979. This Grade B material was of variable P_2O_5 content and was high in aluminum and iron. It was not suitable for normal superphosphate production but can be used satisfactorily for direct application in Malaysia under some agricultural conditions.

Table 4.—Christmas Island: Exports of phosphate rock, by destination

(Thousand metric tons)

Destination	1976	1977	1978
Australia	480	541	610
Indonesia	7	13	15
Malaysia	133	--	135
New Zealand	417	575	624
Singapore	--	133	4
Total	1,037	1,262	1,388

HONG KONG[13]

Hong Kong's gross domestic product (GDP) in 1978 was estimated at United States $12.0 billion in 1977.[14] In constant 1966 prices, the GDP increased 11% from $5.5 billion in 1977 to $6.1 billion in 1978. Services account for about 60.0% of the GDP, followed by manufacturing, 25.0%; agriculture, 1.0%; mining, 0.1%; and other, 13.9%.[15] The British Crown Colony relies almost wholly on foreign raw materials and resources to meet the needs of its population and the requirements of its industries and service-oriented businesses. Aside from tourism, light industries dominate the local economy, which is dependent on sales and shipments of export goods. Production of textiles and clothing, electronic articles, plastic products, watches and clocks, and other consumer articles account for about 70% of the Colony's total domestic export. Moreover, about 68% of the total industrial work force is employed in these sectors. The only heavy industries in Hong Kong are construction and ship building (small vessels) and repairing.

In the past, the principal minerals mined and produced in Hong Kong have included beryl, feldspar, graphite, iron ore, kaolin, quartz, cassiterite, and wolframite. In 1976, the Ma On Shan iron ore mine was closed and remained idle on a standby basis throughout 1977. By 1978, mine production in the Colony was limited to clays, feldspar, quartz, stone, and sand and gravel. Local production of ores and minerals is small and insignificant quite naturally by world standards.

Taiwan was the major market for the feldspar. Local light industries consumed all the quartz, more than half of the kaolin, and some of the feldspar.

Because of heavy demand for construction raw materials, contracts for two new quarries were issued in 1978. One began operations during the year, and the other was scheduled for startup early in 1979. In addition to the two Government quarries, there were seven contract quarries in operation during the year. The Government-owned quarry at Mount Butler was modernized and in full production during 1978. Modernization at the other Government quarry at Diamond Hill in Kowloon began in 1978. Total production of crushed rock aggregates by all quarries was 5.7 million cubic meters in 1979.

A large portion of the sand produced was from dredging deposits in Mirs Bay and lesser amounts from the production of crushed rock. During 1979, Government-owned sand depots sold 987,653 cubic meters of marine sand. The depot at Kowloon Bay was completed in 1978, and construction was started on a sand depot at Lai Chi Kok, which will be used for maintaining service for marine sands. The Government also began designing additional sand depots in Sha Tin and Tai Lam Chung to serve the New Territories.

Under the Mining Ordinance, the Crown has ownership and control of minerals. The land office is empowered to grant mining leases, and the Commissioner of Mines, to grant mining and prospecting licenses. At the end of 1979, there were two mining leases, five mining licenses, and two prospecting licenses valid for various areas in the Colony. The Mines Division of the Labour Department enforces legislation on mining, explosives, and safety regulations. In addition, it processes mining and prospecting applications; inspects mining and prospecting areas, stone quarries, blasting sites, and explosives storage; and issues blasting certificates.

China Light and Power of Hong Kong completed the negotiations for construction of a coal-fired powerplant to be sited in the New Territories. In exchange for electricity to service Guangzhou, China was to supply Hong Kong annually with steam coal. In addition, rail service between the Colony and Guangzhou was increased and electrification of the railway was initiated.

Hong Hong's trade in 1979 totaled $32,484 million. Total two-way trade in 1978 was $24,367 million, an increase of 25% over that of 1977, comprised as follows: $13,137 million for imports; $8,481 million for exports; and $2,749 million for reexports. Imports of raw materials comprised 42% of total imports in 1978 (includes $420 million for iron and steel); followed by consumer goods, 27%; foodstuffs, 14%; and capital goods, 13%. Imports of mineral fuels, lubricants, and related materials during the year were valued at $617 million. Receipts of fuel oil were supplied mainly by Singapore (75%), Bahrain (9%), and China and Iran (each 6%). Japan continued to be the Colony's major supplier of total shipments, accounting for 23% of all imports, followed by China, 17%, and the United States, 12%. Other sources included the Federal Republic of Germany, Israel, Taiwan, Switzerland, and the United Kingdom.

Domestic exports consisted almost entirely of manufactured goods; clothing; textiles and fabrics; watches and clocks; toys; radio receivers; metal manufactures, travel goods; and electronic components and parts, in that order by value. The principal export destinations were the United States, 37% of the total value of domestic exports in 1978; Federal Republic of Germany, 11%; and the United Kingdom, 10%. Shipments ranging between $100 million and $400 million were to Japan, Australia, Canada, Singapore, Netherlands, Switzerland, and Nigeria.

Reexports increased significantly by 34% over that in 1977 and were mainly to Japan, $475 million; Singapore, $290 million; Indonesia, $271 million; and the United States, $257 million. The main originating countries for reexported materials were China, Japan, and the United States.

Table 5.—Hong Kong: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Bauxite and concentrate	8,223	4,500	Taiwan 3,900; Thailand 600.
Oxide and hydroxide	634	3,620	Mainly to Taiwan.
Metal including alloys, all forms	21,164	14,244	Japan 6,741; United States 1,725; Singapore 882.
Arsenic trioxide, pentoxide, acids	37	8	Mainly to Indonesia.
Beryllium metal including alloys, unwrought	--	3	All to United States.
Chromium oxide and hydroxide	70	63	Indonesia 47; China, mainland, 10.
Cobalt oxide and hydroxide	2	21	Belgium-Luxembourg 12; Thailand 4.
Copper:			
Oxide and hydroxide	3	3	Madagascar 2; Malaysia 1.
Metal including alloys, all forms	9,771	11,219	Mainly to Japan.
Gold metal, unworked or partly worked thousand troy ounces	14	84	Japan 55; Taiwan 27.
Iron and steel metal:			
Scrap thousand tons	227	286	Taiwan 178; Japan 56; Thailand 41.
Pig iron, steel ingot, similar material	165	100	Fiji 56; Indonesia 28.
Steel, primary forms	16,028	6,352	Philippines 5,155; Malaysia 852.
Semimanufactures	32,460	50,614	Indonesia 10,771; Macao 10,006; Malaysia 4,402.
Lead:			
Oxide	91	23	Indonesia 15; Singapore 7.
Metal including alloys, all forms	661	1,445	Mainly to Taiwan.
Magnesium metal including alloys, all forms	17	8	Mainly to United States.
Manganese oxide	18	60	Indonesia 50; Taiwan 10.
Nickel:			
Oxide and hydroxide	28	37	Taiwan 20; Republic of Korea 11.
Metal including alloys, all forms	512	1,292	Taiwan 398; Republic of Korea 390; North Korea 150.
Silver metal including alloys thousand troy ounces	646	429	Switzerland 246; United Kingdom 74; Taiwan 64.
Tin metal including alloys, all forms	690	1,013	Taiwan 433; Singapore 230; Philippines 73.
Titanium oxide	25,292	3,036	Indonesia 1,944; Taiwan 455; Pakistan 205.
Tungsten metal including alloys, all forms	1	3	Mainly to United Kingdom.
Zinc:			
Oxide	42	41	Indonesia 18; Macao 14.

See footnotes at end of table.

Table 5.—Hong Kong: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS —Continued			
Zinc —Continued			
Metal including alloys, all forms	2,335	3,963	Vietnam 1,471; Japan 784; Philippines 593.
Other:			
Oxides, hydroxides, peroxides of metals	2	24	United States 18; Thailand 4.
Metals including alloys, all forms:			
Metalloids	11	7	Mainly to Singapore.
Base metals including alloys, all forms, n.e.s	47	446	Belgium-Luxembourg 183; Iran 82; Japan 63.
NONMETALS			
Abrasives, natural:			
Grinding and polishing wheels and stones	555	471	Indonesia 253; Nigeria 65; Taiwan 7.
Other	118	102	Japan 70; Indonesia 16.
Asbestos	215	225	Mainly to Indonesia.
Barite and witherite	11	72	Indonesia 44; Thailand 24.
Cement, hydraulic	1,856	4,084	Indonesia 2,000; Macao 1,588.
Clays and clay products (including all refractory brick):			
Crude	32,177	48,307	Mainly to Taiwan.
Products value, thousands	$1,662	$1,833	Macao $787; Indonesia $498; Nigeria $258.
Diamond:			
Gem, not set or strung thousand carats	355	365	Japan 87; Belgium-Luxembourg 72; Israel 68.
Industrial value, thousands	$77	$19	All to United States.
Diatomaceous earth	43	38	Mainly to India.
Feldspar and fluorspar	3,928	6,385	Singapore 2,400; Taiwan 2,150; Indonesia 1,780.
Fertilizer materials:			
Crude	360	418	Taiwan 224; Singapore 139; Thailand 37.
Manufactured	148	142	Macao 116; Taiwan 14.
Ammonia	14	1	Mainly to Indonesia.
Graphite	1,032	622	Taiwan 310; United States 306.
Gypsum and plasters	840	528	Mainly to Indonesia.
Lime	146	128	Macao 74; Malaysia 54.
Magnesite	690	1,213	Thailand 903; Nigeria 300.
Mica, all forms	58	33	Taiwan 24; Republic of Korea 5.
Pigments, mineral, including processed iron oxides	721	1,015	Indonesia 900; Thailand 56.
Precious and semiprecious stones, including synthetic, except diamond value, thousands	$111,995	$137,322	Japan $71,697; United States $24,462; Singapore $18,340.
Salt and brines	354	35	All to Macao.
Sodium and potassium compounds, n.e.s	1,744	10,277	Mainly to Philippines.
Stone, sand and gravel:			
Dimension stone	2,382	4,350	Indonesia 1,781; Taiwan 1,472; Thailand 697.
Gravel and crushed rock	28	116	Nigeria 58; Indonesia 30.
Quartz and quartzite	370	544	Thailand 282; Ivory Coast 61; Ghana 51.
Sulfur:			
Elemental, all forms	23	54	Philippines 32; Macao 13.
Sulfuric acid	548	50	Macao 37; Indonesia 7.
Talc, steatite, soapstone, pyrophyllite	4,843	5,729	Indonesia 4,809; Taiwan 505.
Other:			
Crude	119	102	Mainly to Taiwan.
Oxides and hydroxides of strontium and barium	50	(1)	All to Malaysia.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	279	352	Macao 201; Indonesia 42.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black and gas carbon	11	830	All to Kampuchea.
Coal and coke, including briquets	74	39	Singapore 20; Macao 19.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	62	85	All to Macao.
Kerosine and jet fuel do	24	65	Indonesia 41; Macao 24.
Distillate fuel oil do	715	1,051	Macao 446; India 227; Japan 202.
Residual fuel oil do	336	218	All to Macao.
Lubricants do	233	223	Taiwan 69; Indonesia 44; Saudi Arabia 44.
Mineral jelly and wax do	8	12	Mainly to Philippines.
Other do	33	47	Indonesia 23; Macao 20.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	6	5	All to Thailand.

[1] Less than 1/2 unit.

Table 6.—Hong Kong: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate	6,345	7,070	All from China, mainland.
Oxide and hydroxide	800	3,018	China, mainland, 2,380; West Germany 176; Japan 111.
Metal including alloys, all forms	36,798	40,158	Canada 10,608; New Zealand 6,306; Japan 4,593.
Arsenic trioxide, pentoxide, acids	55	10	All from China, mainland.
Chromium oxide and hydroxide	10	398	West Germany 253; United States 135.
Cobalt oxide	49	41	Belgium-Luxembourg 22; United Kingdom 19.
Copper:			
Copper sulfate	96	93	Mainly from United Kingdom.
Oxides and hydroxides	171	165	West Germany 95; Japan 48; Australia 1[illegible] Norway 10.
Metal including alloys, all forms	32,299	32,740	Japan 24,498; China: Mainland 1,096 and Taiwan 2,342; Australia 1,474.
Gold metal, unworked and partly worked thousand troy ounces	940	1,764	United Kingdom 937; Switzerland 372; Australia 314.
Iron and steel metal:			
Scrap thousand tons	41	126	Japan 91; Italy 17; United Kingdom 10; Singapore 3.
Pig iron, ferroalloys, similar materials do	21	17	North Korea 10; China, mainland, 4; Australia 1.
Steel, primary forms do	138	184	Australia 154; Republic of South Africa 17; Taiwan 10.
Semimanufactures do	897	1,244	Japan 508; Republic of South Africa 210; China: Mainland 148 and Taiwan 167.
Lead:			
Oxides	486	275	China, mainland, 95; Australia 68; Japan 35; Netherlands 28.
Metal including alloys, all forms	1,636	1,593	Canada 737; Australia 268; Taiwan 245.
Magnesium metal including alloys, all forms	15	32	U.S.S.R. 17; Norway 10; Canada 5.
Manganese:			
Ore and concentrate	554	515	Thailand 480; China, mainland, 35.
Oxides	1,954	2,246	Japan 994; Singapore 821; China, mainland, 369.
Mercury 76-pound flasks	695	1,548	China, mainland, 1,229; Spain 300.
Nickel:			
Oxides	59	174	Canada 126; Australia 21; France 18.
Metal including alloys, all forms	1,024	2,488	Canada 1,401; Japan 228; Republic of South Africa 217; France 175.
Platinum-group metals including alloys, all forms thousand troy ounces	169	124	West Germany 41; United Kingdom 28; Japan 22; Australia 15.
Rare-earth oxides	6	9	Mainly from France.
Silver metal including alloys, all forms thousand troy ounces	889	596	Philippines 207; Australia 101; Switzerland 81.
Tin metal including alloys, all forms	988	1,551	Malaysia 1,119; Thailand 149; China, mainland, 105.
Titanium:			
Ore and concentrate	70	250	All from Australia.
Oxides	4,349	6,968	Japan 2,373; Australia 1,191; United Kingdom 839; Italy 592.
Tungsten metal including alloys, all forms	1	4	Canada 1; Japan 1; United States 1.
Zinc:			
Oxides	574	645	France 227; West Germany 14[illegible]; Singapore 125; Canada 54.
Metal including alloys, all forms	17,395	26,532	Australia 14,179; North Korea 4,779; China, mainland, 2,967.
Other:			
Ash and residue containing nonferrous metals	775	400	All from China, mainland.
Oxides, hydroxides, peroxides of metals	41	117	China, mainland, 70; West Germany 37; Japan 9.
Metals including alloys, all forms:			
Metalloids	17	1	Mainly from United States.
Base metals including alloys, all forms, n.e.s	108	661	China, mainland, 234; Malaysia 129; Singapore 106; Republic of Korea 55.

See footnotes at end of table.

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Table 6.—Hong Kong: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS			
Abrasives, natural:			
Dust and powder of precious stones ____ value	$13,465	$11,829	United Kingdom $5,684; United States $3,707; Belgium-Luxembourg $1,619.
Grinding and polishing wheels and stones	1,356	1,809	China: Mainland 458 and Taiwan 204; Japan 430; Republic of Korea 280.
Other	726	848	Japan 475; United States 316; Italy 39; West Germany 6.
Asbestos	318	2,406	Australia 1,768; China, mainland, 582; United Kingdom 20.
Barite and witherite	291	258	China, mainland, 90; United Kingdom 78; West Germany 50.
Boric acid	260	201	United States 194; China, mainland, 5; United Kingdom 1.
Cement, hydraulic ____ thousand tons	2,102	2,352	Japan 1,004; China: Mainland 716 and Taiwan 287; Republic of Korea 252.
Clays and clay products (including all refractory brick):			
Crude	22,612	26,188	Macao 14,406; China, mainland, 6,010; United States 2,606.
Products ____ value, thousands	$30,221	$37,807	China, mainland, $10,360; Italy $9,601; Japan $7,497; West Germany $2,254.
Cryolite and chiolite	12	17	All from Denmark.
Diamond:			
Gem ____ thousand carats	1,292	1,413	India 505; Israel 385; Belgium-Luxembourg 218; Republic of South Africa 78.
Industrial ____ value, thousands	$81	$277	Australia $274; Switzerland $2; Belgium-Luxembourg $1.
Diatomaceous earth	286	264	All from United States.
Feldspar and fluorspar	3,975	6,327	China, mainland, 6,197; Thailand 130.
Fertilizer materials:			
Crude	874	1,077	Thailand 618; China: Mainland 341 and Taiwan 90.
Manufactured:			
Nitrogenous	3,545	4,554	Japan 3,695; West Germany 319; United Kingdom 172.
Other, including mixed	6,247	6,988	West Germany 5,916; France 496; United Kingdom 399.
Ammonia	804	708	Japan 699; Taiwan 3.
Graphite	1,344	1,201	China, mainland, 787; Sri Lanka 310; Republic of Korea 104.
Gypsum and plasters	52,823	62,120	Japan 55,677; Republic of Korea 3,300; United Kingdom 899.
Lime	51,041	32,918	China: Mainland 28,979 and Taiwan 2,252.
Magnesite	1,563	2,413	China, mainland, 2,104; Japan 300.
Mica, all forms	252	337	Japan 249; India 69; Belgium-Luxembourg 4; Taiwan 4.
Pigments, mineral, including processed iron oxides	1,006	1,439	China, mainland, 812; Japan 229; United States 178.
Precious and semiprecious stones, including synthetic, except diamond ____ value, thousands	$66,934	$77,601	Singapore $15,478; Australia $9,742; Thailand $9,391; Sri Lanka $7,979.
Salt	55,143	57,985	China: Mainland 27,593 and Taiwan 11,800; West Germany 5,118.
Sodium and potassium compounds, n.e.s	16,699	27,780	United States 10,597; China, mainland, 9,653; Romania 2,110.
Stone, sand and gravel:			
Dimension stone	5,947	4,525	Italy 2,129; China, mainland, 1,766; Philippines 168.
Gravel and crushed rock	293,577	276,685	Macao 221,948; China: Mainland 53,796 and Taiwan 389.
Limestone, except dimension	6,333	24,607	China: Mainland 23,353 and Taiwan 825; Vietnam 300.
Quartz and quartzite	2,973	4,021	China, mainland, 3,945; West Germany 26; Macao 25.
Sand, excluding metal bearing	788,134	991,358	China: Mainland 990,771 and Taiwan 250; Vietnam 100.
Sulfur:			
Elemental, all forms	2,309	1,624	Japan 1,165; West Germany 244; Singapore 150; Taiwan 42.

See footnotes at end of table.

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Table 6.—Hong Kong: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Sulfur —Continued			
Sulfuric acid	4,708	11,189	Japan 9,277; China: Mainland 90 and Taiwan 1,719.
Talc and related materials	7,207	7,684	China: Mainland 6,983 and Taiwan 120; United States 326; Pakistan 100.
Other:			
Crude	5,386	6,064	China, mainland, 5,850; Republic of South Africa 90; United Kingdom 56.
Mineral waste	7,455	1,605	China: Mainland 564 and Taiwan 556; Thailand 407.
Oxides, hydroxides, and peroxides of magnesium, strontium, barium	55	5	United States 3; Japan 1; United Kingdom 1.
Bromine, iodine, fluorine	5	1	Mainly from Japan.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	20,259	20,363	United Kingdom 5,149; United States 4,180; Taiwan 2,779.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	193	1,129	Republic of Korea 525; United Kingdom 291; Taiwan 273.
Carbon black and gas carbon	749	1,244	Australia 491; Japan 444; United States 169; West Germany 64.
Coal, coke, and peat, including briquets	15,972	8,079	Japan 4,998; China: Mainland 2,182 and Taiwan 617.
Petroleum refinery products:			
Gasoline, including natural thousand 42-gallon barrels	1,228	1,527	Singapore 1,053; Republic of Korea 194; China, mainland, 159.
Kerosine, aviation and industrial, and white spirit do	6,648	6,425	Singapore 3,706; China: Mainland 1,906 and Taiwan 339.
Diesel and distillate fuel oil do	8,710	9,688	China, mainland, 6,090; Singapore 3,137; Kuwait 207.
Residual fuel oil do	24,896	26,067	Singapore 19,635; Bahrain [illegible]; China, mainland, 1,671.
Lubricants do	49	16	China, mainland, 7; Singapore 2; United Kingdom 2; United States 2.
Other:			
Mineral jelly and wax do	86	109	China, mainland, 90; Japan 5; United States 4; United Kingdom 3.
Bitumen and other mixtures do	188	144	Singapore 132; Taiwan 5; Republic of Korea 4.
Liquefied petroleum gas do	1,057	1,146	Singapore 645; Republic of Korea 308; Japan 193.
Unspecified do	1	1	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	297	186	United Kingdom 82; Netherlands 51; United States 33; Japan 20.

NA Not available.

KAMPUCHEA[16]

Intermittent armed conflict continued during the first part of 1978 along the Kampuchea-Vietnam border, then all-out warfare erupted at yearend. On January 7, 1979, Phnom Penh, and the Pol Pot Government, was overthrown by the Kampuchean National United Front for National Salvation, heavily aided by Vietnam forces. On January 10, 1979, the formation of the People's Republic of Kampuchea was announced.[17] The Government's preoccupation with political, military, and ideological concerns precluded any meaningful economic development in the country during this time. Mineral production was insignificant. Factual information on the situation in Kampuchea was unavailable due to the chaotic conditions within the country and along the border areas. Official economic data was not released, and it is doubtful whether comprehensive data were even collected. The population reverted to mostly subsistence agriculture during 1978 and 1979.

Hitherto, the overall value of the mineral sector was negligible, and local mining operations served only the needs of local immediate users. The country has never been considered an important world producer of any mineral commodity. A variety of minerals might be developed given halcyon times and a thorough exploration effort using modern geophysical and geochemical surveying techniques. The only minerals that have been produced on a significant level were phosphate rock, gems, salt, and nonmetallic construction materials for cement, brick, and tile manufacture.

Bauxite was known to occur in commercial quantities, but no development plans were made known. Deposits of antimony, copper, gold, iron, manganese, and tin minerals and coking coal reportedly have been identified.

No meaningful trade figures were available for 1978 or 1979. Exports of agriculture products probably totaled less than $1 million in value in 1978, while imports from Japan, Singapore, and Hong Kong were estimated at less than $2 million. Imports presumably from China and other countries probably consisted of pharmaceuticals, foodstuff, insecticides, fertilizer, steel manufactures, textile yarns, petroleum products, farm equipment, machinery, replacement and spare parts, and relief aid sent by governments and humanitarian agencies from around the world.

COMMODITY REVIEW

Bricks made from local clay minerals were produced at small plants in several of the Provinces during 1978. The Ao-3 kiln in Phnom Penh planned to produce 10,000,000 bricks,[18] the factory at Phum Prek Rieng doubled its 1977 production figures to 100,000 per month, and the factory in Tram Kak district claimed they could make 40,000 bricks "at a time."[19] There was also a local plant in operation in the Angkor Chey district, and a new 8-kiln factory in Chamkar Lev District began operations in May 1978. These small operations also provided roofing tiles and a variety of earthenware containers to immediate areas. Reportedly, some of these operations resumed production at the end of 1979.

An effort was being made to develop a small steel industry. During 1978, the Government was reportedly in the process of building a "steel mill" which would produce a quarter of the country's annual needs.[20] Also under construction was an ironworks of medium size as an industrial developmental project. Status of this project during 1979 was not known. The search for economic deposits of iron ore continued, and it was generally believed that sufficient reserves existed to support a modest steel industry. Crude iron foundries were operating at several locations. These were locally made, batch-fired, charcoal-fueled furnaces. Charges consisted of various types of steel or iron scrap, additives, and some locally produced iron ore. While production was only on the order of 1 or 2 tons per firing, the product was reported to be a good grade of malleable iron. Output from these smelters was used to turn out plowshares and other agricultural tools, pots, pans, pump parts, tools, metal fasteners, and replacement parts for a wide range of equipment.

Prime Minister Pol Pot, in his party anniversary speech on October 2, 1978, stated, "Our oil refinery is being repaired, and this repair work will be completed by the end of 1979. This refinery, when completed, will be able to refine 600,000 tons of crude oil a year."[21] Due to the change of government, however, no progress was made toward that completion. This small, old French refinery has not been maintained during the 8 years since it was damaged in military conflict. Total reconstruction by a large crew of foreign specialists would be necessary to bring the plant back into operation in light of deterioration as a result of tropic conditions.

Kampuchea produces no crude oil or natural gas nor was there any known exploration conducted either onshore or offshore. The country's modest petroleum needs were satisfied by imports of petroleum products.

Phosphate deposits in Battambang and Kampot Provinces were being exploited. The phosphate rock is simply ground to a fine powder and applied directly to cropland. No chemical processing or blending is attempted. The largest phosphate plant in the country was the Tuk Meas plant in Kampot Province, about 16 kilometers from the Vietnamese border. It was not known if the plant operated during 1979. The Monkol Borei phosphate fertilizer plant in Battambung Province, which opened in 1977, apparently operated satisfactorily during 1978. Reserves near the plant of 20% P_2O_5 ore were reportedly as high as 400,000 tons.[22]

Kampuchea produced salt for domestic consumption by evaporation of seawater. By mid-1979, it was reported that the salt pans of Kampot and Kompong Trach District were being brought back into production.

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These beds could yield about 60,000 tons per year of salt.[23] Limestone was also mined near Chakrei Ting for use in a small local cement plant.

LAOS[24]

The People's Republic of Laos, a landlocked country of 3.2 million people, completed its third and fourth years of independence amid continuing troubles in its quest for national unity and consolidation of the national Government of the Pathet Lao. The Government had minimal success in effectively setting in motion its first 3-year plan, an interim plan to prepare the way for a full 5-year plan beginning in 1980 or 1981. The economy continued to be unstable and the national currency, the kip, fluctuated throughout 1978 and was revalued in 1979. Firm data or information were virtually unavailable on the economy of the country as a whole, much less on the mineral industry in particular.

Laos remained one of the poorest countries in the world with a gross national production currently around $260 million and a per capita income on the order of $90 per year.

The country is believed to be rich in natural resources, with a variety of minerals including tin, iron ore, salt, potash, gypsum, and coal. Moreover, there is a great potential for developing hydroelectric power, and 60% of the land is forested. Despite the potential, its resources remained practically untouched during the year and very little in the way of detailed geological surveying has been done for a country of its size.

Laos was not a major world producer of any mineral, and the small overall mineral output was of little importance to the economy of this agricultural country in 1978 and 1979. Between 500 and 1,000 tons of tin concentrate was produced annually before the nationalization of the French-owned Phontiou mine in 1977.

One critical factor affecting both the exploration and development of the mineral industry was the lack of an adequate transportation system. Any plans for large-scale exploitation of potash, iron ore, or salt deposits would be severely handicapped by the woefully few, poorly maintained roads and nonexisting rail system.

However, during 1978 and 1979 road construction and improvements were emphasized. Although a major problem continued to be the inadequate organization and management of manpower, a number of projects were reportedly completed. For instance, over 2,700 kilometers of new roads were built, and 240 bridges were constructed or repaired.

The Government's primary objective has been to achieve self-sufficiency in food production by 1980. However, the droughts of 1977 were followed by flooding in 1978, and a worsening political climate in 1979 fostered overzealous socialist programs. The people were highly resistant to being forced to join agricultural cooperatives and, in fact, large numbers fled to Thailand rather than comply.[25]

Phase 2 construction of the Nam Ngum hydroelectric project, north of Vientiane, was completed and commissioned in November 1978. The project was the largest man made structure in Laos, and after the capacity increase from 30 megawatts to 110 megawatts, was capable of generating more than five times as much electric power as Laos needed.[26] As a result, the sale of surplus electricity to Thailand increased from $2 million to over $7 million, the country's largest foreign exchange earner. Electric power output for domestic use increased to about 340 million kilowatt-hours, an increase of 16% over that of 1977. Twenty-one water pumping stations were reportedly installed serving agricultural state farms and nearby factories. The electric power grid was to be extended into the more remote communities, and it was expected that some previously inaccessible mineral deposits could then be developed.

COMMODITY REVIEW

Before the nationalization of the tin mines at Phontiou owned by Société d'Etudes et d'Exploration Minière de l'Indochine, tin was the major foreign exchange earner for Laos, bringing in several million dollars annually. The mines were wholly nonproductive for a time, but in 1978, were operating on a much reduced level. The low-grade ore (0.2%-0.5% Sn) was difficult to concentrate in spite of reported assistance by foreign technicians. Equipment maintenance, and obtaining spare parts were particularily difficult inasmuch as the machinery was of French, British, and U.S. manufacture. Laos officials expressed hope that, with Soviet assistance, production would reach 800 tons of tin concentrate during 1979.[27] Actual production was probably much less. Export of tin concentrate to Malaysia for smelting proved difficult owing to legal action from the former owners of the mine. The second tin mine, in the Boneng District, exported about 100 tons of concentrates to Malaysia for smelting in 1978. The total tin reserves were estimated to be far larger than the 65,000 tons already proved, but Laos had difficulty in obtaining foreign assistance in developing mines owing to the uncompensated nationalization at Phontiou.

The output of salt in the Vientiane area continued to be a locally important mineral product. The Industrial Department in Vientiane Province and Vientiane City built reservoirs for the local people and provided them with saltmaking equipment. At some sites, notably the Ban Keun area, water pumps were also installed to increase production. The salt was being obtained in part from ground water brines. Total production figures from these works were unavailable but were estimated to have been near 15,000 tons during 1978 and a similar amount during 1979, meeting local needs handily and providing a surplus for distribution to other Provinces.[28]

Efforts by the Government to obtain foreign assistance in developing the rich potash deposits along the Mekong River were unsuccessful. The extensive bed of sylvite, which continued southward into Thailand, averaged 3.5 meters thick and occurred at depths between 94 and 432 meters.

The largest identified mineral resource in Laos was iron ore, occurring in Xiangkhouang Province.[29] The two most favorable deposits were at Phou Nhouan and Pha Lek. In 1979, an agreement was signed with Vietnam for geological exploration of this resource which is known to contain several hundred million tons of high-grade magnetite and adjacent areas of limonite and hematite.

Gypsum occurrences were found in Savannakehet Province. An agreement was signed with Vietnam in April 1978 to cooperate in the construction of a mine for exploitation of gypsum. No information has been released as to the expected capacity of the mine. Presumably, much of the output will be exported to Vietnam.

There was no further exploration and activity during 1978 or 1979 on the reported oil discovery of a number of years ago between Thakhek and Pakse. Laos continued to import the small amounts of petroleum products needed from Thailand. In late 1979, a petroleum storage tank farm was completed with Soviet assistance at Dong Chong hamlet near Vientiane. The capacity of the eight tanks totaled 8,000 cubic meters (50,000 barrels). In addition, Vietnamese engineers completed a 900-cubic-meter (5,500-barrel) petroleum storage site in Laos during 1979.

Coal remained of minor importance to the Laotian mineral economy with only a few thousand tons being mined from the coalfields near Muang Vangviang. Coal was also known to occur in Saravane Province.

MONGOLIA[30]

Mongolia's sixth 5-year plan (1976-80) would transform the country into an industrial-agrarian-based economy. The plan called for closer integration of Mongolian and Soviet economies under the direction of the Mongolian-Soviet Intergovernmental Commission for Economic, Scientific, and Technological Cooperation. The plan stressed higher labor efficiency, increased industrial and agricultural output, and better product quality, and set a target of a 62.9% increase in gross industrial production over the 5-year period. Electrical generation was to reach 1,450 megawatt hours annually by 1980, and coal production, to reach 4.8 million tons. Output of bricks, timber, and other construction materials were to increase substantially to meet industrial development. As a basis for industrialization, much emphasis was to be placed on developing the mining industry, in particular coal, copper and molybdenum, fluorspar, and geological surveying for potential mineral deposits for commercial exploitation.

Mongolia continued to be dependent on foreign assistance. Harsh weather conditions in 1977-78 had compounded the country's economic development in the agricultural and animal husbandry sectors. Government revenue in 1978 was estimated at 3,600 million tugriks compared with Government expenditure of 3,650 million tugriks. Mongolia exports mainly raw materials and foods but imports value-added goods, such as machinery and plant equipment, manufactured consumer products, and petroleum. Eighty percent of Mongolia's external trade is with the U.S.S.R. and in 1977, the total two-way trade was estimated at 676 million rubles. Trade in 1978 was estimated to be 700 million rubles with Soviet exports to Mongolia comprising about 90% of the total. The principal source of outside financial assistance was the U.S.S.R. and the Council for Mutual Economic Assistance (CMEA).[31]

Most of the capital investment in 1978-79 for industrial expansion was largely for the copper and molybdenum development at Erdenet in Bulgan Province. This mining complex was also to be a large city combine with housing, schools, shops, and other industries such as carpeting manufacture. In 1978, it was estimated that there was a population of 32,000 with a work force of 14,000 Mongolians and Soviets engaged in construction. Also, under Soviet tutelage, training was in progress for 2,600 workers, engineers, and technicians for the mine. In August 1978, it was claimed that 6 million cubic meters of overburden had been moved and that 3 million tons of ore had been excavated. Opening of the combine, originally set for 1979, was announced as October 7, 1978. The 220-kilovolt powerline from Gusinoozersk in the U.S.S.R. to the industrial combine had been completed in 1976, and the power station's first generator was put on load utilizing coal from Gusinoozersk. Construction of a water pipeline from the Selange River was completed, measuring 80 centimeters in diameter and running 64 kilometers with a capacity to deliver 1,000 cubic meters of water an hour. Passenger train service was opened, linking Erdenet with Darhan and Ulan Bator in June 1977, and construction of a 265-meter bridge was completed across the Selange River providing railway access to Ulan Bator and timber from the Selange sawmill.

Fluorspar is produced by the Berhin fluorite mine. Reconstruction of the mine was well underway and, reportedly, construction of a similar enterprise began during the year near the area. Construction of the fluorite mine at Boro Ondor in southeastern Mongolia, described as the country's largest fluorite mine, had begun in 1977 with Soviet assistance. By the end of the current economic plan, export of fluorspar was expected to reach 2.1 times the current level.

Coal mining continued to be one of Mongolia's foremost mineral industries. About 75% of the country's coal output came from open pit mines with the bulk of the production from Nalayha, Sharyn Gol, land Chuluum. Development and construction purportedly begin in 1978 in a large open pit coal mine at Baga Nuur, located about 110 kilometers southeast of Ulan bator. A rail link with the Trans-Mongolian Railway was completed in 1978, and a high-voltage transmission line from Ulan Bator to Baga Muur was near completion. Development of this mine, scheduled for 1980, was to be one of the largest coal mining enterprises in the State, producing 2 million tons of coal a year. The output of lignite from this mine was to be the main supplier for 15 to 20 years for a 1,000-megawatt thermal power station, slated to be the country's main electricity producer. The new city combine was to be built along the bank of Hulsa River, containing housing initially for 20,000 people.

Prospects for other mineral developments in Mongolia included the Tavantolgoy coking coal deposit in the Tsogttsetsiy district of South Gobi Province; the Borondor copper-molybdenum deposit in South Gobi Province; and the Tsagaansuvraga copper-molybdenum deposit in East Gobi Province. Unlike Erdenet, the latter would include metallurgical works as well as a concentrator if development was undertaken. These projects were expected to be carried out under assistance from CMEA.

Table 7.—Mongolia: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum metal including alloys, semimanufactures	--	[2]1	All from Switzerland.
Iron and steel metal:			
Pig iron	1,400	1,400	All from U.S.S.R.
Rolled semimanufactures	14,100	30,200	Do.
Pipes and tubes	1,900	5,800	Mainly from U.S.S.R.
NONMETALS			
Cement thousand tons	100	67	U.S.S.R. 60.
Clay products, refractory	[2]3,329	[2]2,315	All from U.S.S.R.
Fertilizer materials, manufactured:			
Nitrogenous, N content	17,600	25,800	U.S.S.R. 15,484.
Phosphatic, P_2O_5 content	7,700	18,900	Mainly from U.S.S.R.
Salt	[2]2,902	[2]4,262	All from U.S.S.R.
Sodium compounds, n.e.s.:			
Caustic soda	700	100	NA.
Soda ash	1,000	--	
Sulfuric acid	200	1,200	All from U.S.S.R.
MINERAL FUELS AND RELATED MATERIALS			
Coal: Anthracite and bituminous	[2]800	[2]100	Do.
Petroleum:			
Crude thousand 42-gallon barrels	37	42	Do.
Refinery products do	3,280	3,290	Mainly from U.S.S.R.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	[2]1,003	[2]1,008	All from U.S.S.R.

NA Not available.

[1] Owing to the lack of official trade data published by Mongolia, this table should not be taken as a complete presentation of Mongolia's mineral imports, with regard to either commodities or quantities. Unless otherwise specified, data are compiled from the Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow.

[2] United Nations. World Trade Annual, Walker and Co., New York.

NEPAL[32]

Nepal occupies the south slope of the Himalayan Mountains and forms a buffer state along part of the China-India border. Although the country has a considerable potential for mineral development, it has virtually no important mineral production. The mining industry accounted for approximately 0.01% of the gross domestic product (GDP) in 1978 and the manufacturing sector accounted for an additional 3.1%. Agriculture accounts for nearly two-thirds of the GDP and directly employs over 89% of the workforce. The farming throughout most of the country is on a local, household level with small amounts of surplus foodgrains exported.

The economic growth rate was nearly stagnant over the last two years. GDP in constant FY 1977[33] prices was $1,445 million in FY 1976,[34] $1,470 million in FY 1977-78 and estimated at $1,531 million in FY 1978-79. Per capita GDP in FY 1976-77 was $110 and rose only to $112 by the end of FY 1978-79.

Total exports were $91 million in 1978-79, a small decline over that of 1976-77. Imports, however, increased significantly from $167 million in 1976-77 to $242 million in 1978-79.

Two of the country's main problems were high population density on arable land, and a population increase of 2.5% per year that tends to offset the gains the country makes in economic and industrial development. Another important limiting factor is lack of basic infrastructure. There is no railroad network and the road network is at best primitive. The Government has been working steadily on expanding and upgrading roads and a considerable mileage of motorable roads have been completed in recent years. Opening of hitherto inaccessible areas to motor vehicles will help facilitate mineral exploration efforts.

Despite the scarcity of major mining operations, there has been some small-scale exploitation of several minerals during historic times. Most of the ancient Nepalese weapons were made from magnetite ore mined in Ramechap District and smelted locally. Primitive copper mines have been worked in several areas east of Kathmandu. A few are still operating, including one at Wapsa Khani in old Okhaldhunga District. Each operation is totally manual and can produce about 1,000 kilograms per year of copper metal for local fabrication into domestic utensils. Limestone, slate, dimension stone, and brick clays have all been locally exploited in recent times.

The Mineral Exploration Development Board (Nepal) and a United Nations Development Program team had conducted three field seasons of basic mineral surveying in central Nepal. The two main objectives of the jointly funded project were (1) to determine the mineral potential of a selected representative area, and (2) to strengthen the capability of the government geologists in exploration and analytical techniques. Regional geochemical mapping was undertaken and revealed a large number of anomalies. Almost all of the ancient base-metal workings were reflected in geochemical data. The reconnaissance data in fact revealed the presence of several previously unknown old workings.

Preliminary findings of the survey indicate that it is probable that economically attractive sulfide deposits exist in the area. Copper, lead, and zinc were the main metals indicated and the possibility of silver as a coproduct or byproduct also exists.

A considerable amount of detailed and expensive drilling will be necessary to locate and evaluate specific ore bodies. The ultimate controlling economic factor may well be the distance of a deposit from a motorable road and the cost of bringing roads, electric power, and housing into rugged sites.

COMMODITY REVIEW

Cement continued to be the most important mineral-based industry in Nepal. The 50,000-ton-per-year Himal cement plant was not able to operate at its designed capacity during 1978 and 1979. Problems with maintenance, spare parts, and raw material all combined to cut production at a time when demand far exceeded design capacity. Accordingly, shortages of cement caused delays in several construction projects and resulted in the import of large amounts of expensive foreign cement. Even with imports, cement was still in short supply at yearend 1979.

The Asian Development Bank provided a $40 million loan in late 1976 for the construction of a new cement plant at Hetuada south of Kathmandu. Progress has been slow since the loan was made. Construction apparently got underway during 1978 on infrastructure and site preparation for the plant. An Indian firm was reportedly chosen as the engineering contractor. The 260,000-ton-per-year plant was scheduled for completion in late 1981. A 13-kilometer aerial tramway will transport the raw material from the Bhaise limestone deposit to the plant.

In September 1978, Nepal and India completed a preliminary agreement on the establishment of a 1,500-ton-per-day export-oriented cement plant in Udaypur in southeast Nepal. India will have a 49% equity in the facility. In April 1979, the two countries began a joint survey to determine the route of a 50-kilometer railroad spur to the plant from the end of an Indian railroad line at Jaynagar (26°35'N, 86°09'E) in Bihar. The railroad will bring in coal and carry the cement out of Nepal.

In February 1979, Chinese representatives turned over Bhaktapur Brick and Tile Factory Ltd. to the Nepal Government. The plant, built at a cost of $3.3 million with Chinese assistance, has a capacity to produce 20 million bricks per year (approximately 50,000 tons).

After detailed study of the Kharidhunga magnesite deposit, the Nepalese Department of Mines and Geology has reached an agreement with Orissa Industries Ltd. of India to establish a magnesite mining operation at the site. The Nepal Government will take a 50% interest in the new company. Production from the mine will supply a 50,000-ton-per-year dead burnt magnesite plant to be set up at Lamusangu, which will provide raw materials for a planned basic refractories plant at Birganj.

The average minable thickness of the orebody is 55 meters and is near enough to the surface to be mined by open pit methods. Proved reserves of high-grade ore are about 12 million tons; total reserves were estimated at 180 million tons.[38]

After several years of delay, the Nepal Metal Company began the ground work for exploiting the small high-grade zinc and lead deposit in Ganesh Himal area of Rasuwa district. Shares of stock in the company were being offered and personnel was being hired at yearend 1979. The underground mine will be designed to produce 400 tons per day of ore averaging over 12% combined metal content. A small mill will produce concentrate for export to India. This will be the first modern metal mine in Nepal and is scheduled to begin operating in 1984.

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SINGAPORE[36]

During the past decade, Singapore's gross domestic product (GDP) grew at an average annual rate of 9.6% in terms of constant 1968 prices. GDP reached $4.9 billion[37] in 1979, compared to $4.4 billion in 1978, and $3.8 billion in 1977. Singapore is a stellar performer in the Far East. In addition to being an entrepôt, the Republic's economy is buoyed with diverse industrial activities including petroleum, light manufacturing, ship building and repairing, and tourism.

Singapore is the third largest petroleum refining center in the world. Output by this sector alone was estimated to be valued at $4.4 billion in 1979 compared with $3.3 billion in 1978. The industry was expected to expand further with commitments by Mitsubishi Inc., Mobil Oil Co., Phillips Petroleum Co., and Sumitomo Co. for new petrochemical and associated projects, planned and in progress. Singapore is also Southeast Asia's oil exploration support center. Demand for oil rig construction for world exploration activities was reflected by a growth of about 15% in 1979 in Singapore's equipment industry.

In terms of activity, Singapore is considered the fourth largest port in the world (after Rotterdam, it is also the second largest non-U.S. oil refining center). The Republic is the major port in the area for transshipments of goods. In 1979, imports and exports were valued at $17.4 billion and $14.1 billion, respectively, compared with $13.0 billion and $10.1 billion in 1978. Trade with Japan, Malaysia, and the U.S. collectively accounted for 39% of Singapore's total trade in 1979 and 40% in 1978.

After the petroleum industry, manufacture by the electronics sector is the largest single producer by value. Output was valued at $1.8 billion in 1979 and at $1.4 billion in 1978. The value of iron and steel output in 1979 was $118 million; nonferrous metals, $30 million; cement, $93 million; and nonmetallics, $55 million.

Because of the inflow of foreign capital for new projects, the net manufacturing investment commitments in Singapore for 1978 totaled $353.5 million. Because of the Sumitomo petrochemical complex and associated downstream projects, along with other investments in high-value equipment and machinery, manufacturing commitments in 1979 were around $489 million.

The financial sector continued to expand in 1979 with bank deposits increasing by 16% and loans increasing by 28%. Paralleling the progress in industry, trade, and tourism, Singapore was becoming a major international financial center through the development of its Asian dollar, gold, and secondary money market. The Republic's foreign reserves position improved from $3.39 billion at yearend 1977, to $3.97 billion in 1978, reaching $5.22 billion at yearend 1979. Inflation during 1979 was 4% resulting directly from higher petroleum prices, which reflected the higher costs for energy, wages, imported consumer products, and transport rates.

PRODUCTION

Singapore's mineral economy is basically a pattern of processing foreign raw materials (and/or intermediate materials) and domestic scrap into finished products. More than 1 million tons per year of cement was produced to sustain continued high levels of construction, but the principal raw material was actually imported clinker. Output of cement and concrete products by 7 establishments employing 1,919 workers was valued at $136 million in 1979. The roughly 200,000 tons of ingot steel produced annually in recent years was from scrap; actually, Singapore also imported much larger tonnages of steel products and semimanufactures, some of which was converted to downstream products. The country's value added for cement in 1979 was $22 million; concrete products, $16 million; iron and steel, $56 million; nonferrous metals, $7 million; and nonmetallic minerals, $25 million.

In 1979, Singapore's petroleum industry, employing 3,149 workers, produced about $4.37 billion worth of petroleum products by processing $3.92 billion worth of crude oil, thereby earning $450 million in value added.[38] In 1978, corresponding output was $3.30 billion, input was $2.96 billion, and value added was $340 million. Residual fuel oil ranked first in production tonnage, followed by distillate fuel oil, gasoline, jet fuel, kerosine, and lubricants, in that order. The refining industry recovered somewhat from the loss of the Vietnamese market and Japanese reluctance to buy refined oil. Refining capacity utilization was about 84% in 1979. The country's mineral production statistics are shown in table 1.

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TRADE

Singapore's total foreign trade in 1979 was valued at $31.5 billion (imports, $17.4 billion and exports, $14.1 billion), compared with imports of $13.0 billion and exports of $10.1 billion in 1978. In terms of total trade, Singapore's major trade partners were Malaysia ($4.46 billion), the United States ($4.43 billion), Japan ($4.32 billion), Hong Kong ($1.33 billion), West Germany ($1.12 billion), Thailand ($1.09 billion), and United Kingdom ($1.05 billion). Significantly, trade with China has increased annually, and in 1976 was valued at $343 million; 1977, at $371 million; 1978, at $412 million; and 1979, at $574 million.

In terms of commodity classification, Singapore's most important mineral-related imports in 1979 were crude petroleum, $3,778 million; petroleum products, $616 million; and steel plates, sheets, bars, and shapes, $345 million. Other major import classes in 1979 included office machinery ($1,336 million), industrial machinery and other equipment ($1,246 million), and textiles ($506 million). Comparable export categories were petroleum products ($3,319 million), machinery of all types ($1,679 million), crude rubber ($1,319 million), and telecommunications apparatus ($783 million).

The entrepôt nature of Singapore is exemplified by petroleum. In 1979, the Republic imported 28.2 million tons of crude petroleum, 0.3 million tons of diesel fuel, and 3.5 million tons of kerosine and other fuels. Conversely, exports in 1979 included 1.6 million tons of motor fuel; aviation fuel, 2.2 million tons; naphtha, 2.2 million tons; diesel fuel, 4.1 million tons; kerosine, 10.4 million tons; and lubricating oil, 0.5 million tons. In addition to sales of refined products, there was appreciable monies earned from bunkering.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—The steel ingots, produced locally from scrap, amount to about 200,000 tons annually. The ingots, along with imported sheets and bars, are then made mainly into rolled semimanufactures. There were 14 small iron and steel establishments in 1979, employing 1,454 workers. Only two steel producers were of any consequence, namely the National Iron and Steel Mills Ltd. (NISM) and the Malaysia Iron and Steel Mills Ltd. NISM's plant at Jurong has electric furnaces, merchant bar mills, and a wire rodmill which together turn out more than 200,000 tons of steel products annually. NISM and Japan's Mitsui Co. have a small joint venture called Eastern Wire Manufacturing Co. Malaysia Mills' facilities are considerably smaller than those of NISM.

Tin.—This small island nation has no mine tin production. However, it plays a key role as a leading clearinghouse for Southeast Asia's tin smuggling syndicates.[8] The average wholesale price for tin per picul has risen annually since 1975. Unit price in 1977 was $652; 1978, $768; and 1979, $889. As reported by official (Government) sources, imports of tin-in-concentrates rose from 706 tons in 1976 and 2,290 tons in 1977, to 4,432 tons in 1978. The country's largest tin buyer is Kin Hok. Two new tin smelters have been recently built in Singapore, both in the Jurong industrial estate and owned by Kimetal Pty. Ltd. and Watson Mineral Enterprises. According to company executives, these smelters together can handle 5,000 tons per year as reflected by a 5,242-metric-ton gap between imported and exported tin metal in 1978. Accordingly, the two smelters were assumed to have been working at full capacity.

Before the construction and commissioning of the smelters, official imports of concentrates in 1976 (about 72% tin grade) were 982 tons, compared with exports of 5,498 tons. At the time, tin was worth well over $10,000 per ton. During 1978, more than 15,000 tons of tin concentrates and refined tin were exported, showing heavy traffic in both concentrates and metal. Singapore exported 6,112 tons of tin-in-concentrates in 1978. Customs officials have been unable to stop the steady stream of concentrates brought in by illegal operators, poachers, and intermediaries. Tin from Burma, Indonesia, Laos, Malaysia, and Thailand is transported across the Johore causeway by small boats, trucks, and private cars. About 10 small operations handle the influx. Exported concentrates have gone mainly to smelters in Spain, the Soviet Union, Brazil, and to a lesser extent to Mexico, Portugal, Republic of Korea, and Taiwan.

Nonmetals.—*Cement.*—Singapore had seven cement grinding and mixing establishments in 1979, employing 571 workers and realizing $21.7 million worth of value added from an output of $93.5 million and an input of $71.8 million. Virtually all production of cement was from grinding operations relying on imports of clinker. Singapore's imports of such clinker during 1979 was mostly from Japan and some from the Republic of Korea and Taiwan. Output of finished cement is closely tied to the amounts of clinker imported. Singapore's imports of finished cement have always been considerably less than 100,000 tons annually. Construction activities have averaged about $0.25 billion yearly during 1973-79, which represented about 6% of the GNP. One of the recent large construction projects was the international airport at Changi and its connecting expressway to the downtown district.

Three relatively old cement plants are Asia Cement (Malaysia) Ltd.'s 420,000-ton-per-year plant at Jurong; Singapore Cement Manufacturing Co. Ltd.'s 320,000-ton plant; and Pan Malaysia Cement Works Ltd.'s 260,000-ton plant at Jurong. Ssangyong Cement Pte. Ltd. of the Republic of Korea, purchased a $32 million, 600,000-ton clinker grinding system from the Fuller Co. for a joint venture in Singapore.[40] This "pollution-free" plant, with a 4,000-horsepower finish grinding mill and in-plant dust collector, started operations in 1978 and was running smoothly. Ssangyong's partners included the Development Bank of Singapore and the Afro-Asian Shipping Co. Pte. Ltd., both headquartered in Singapore.

Mineral Fuels.—*Petroleum.*—After Singapore had expanded oil refining capacity to nearly a 1-million-barrel-per-day throughput in early 1977, it became the world's No. 3 refining complex after Rotterdam and Houston. Shell Eastern Petroleum Ltd. (Shell) had expanded its refinery on Pulau Bukom Island to 550,000-barrels-per-day, making this operation the world's second largest single refinery after another of Shell's refineries at Rotterdam. At yearend 1978, Shell was operating close to capacity, whereas other Singapore refineries worked at around 60%. Esso Singapore Pvt. Ltd. (Esso) has a 230,000-barrel-per-day refinery at Pulau Ayer Chaway; Mobil Oil Singapore Pte. Ltd., a 180,000-barrel-per-day refinery in the Jurong Industrial Estate; and Singapore Petroleum Co. and B.P. Refinery Singapore Pte. Ltd., smaller refineries.

Singapore's refining companies redesigned facilities during 1977-78 in order to handle a greater variety of crudes and to produce more lighter products and distillates like automotive diesel oil and kerosine. Also, Singapore refineries had been designed for the high-sulfur crudes of the Middle East, and some redesigning took place in this regard also.

The Singapore Petroleum Co. installed a 15,000-barrel-per-day hydrocracking unit and started to expand its 70,000-barrel refinery by 100,000 barrels additional at a cost of $185 million. Mobil Oil announced a plan to add a S$200 million visbreaker and associated facilities allowing Mobil to produce higher value products such as kerosine and naphtha. The visbreaker will have a refinering capacity of 50,000 barrels per day of residual fuel oil. Royal Dutch Shell was adding a $144 million hydrocracking unit at its big refinery. Another dimension to Singapore's downstream oil activities was the expected construction of a large petrochemical complex on Pulau Ayer Merbau by a joint venture headed by Sumitomo Chemical Corp. of Japan and the Government of Singapore scheduled to come onstream in 1982-83. Initial proposals for the $1 billion complex include capacity to produce 100,000 tons of polyprophylene, 50,000 tons of polyethylene, and 100,000 tons of ethylene oxide. Other proposed projects included a Mitsubishi-Shell venture for downstream ethylene glycol and ethylene oxide plants, and Phillips Petroleum interest in a high-density polyethylene plant.

Many international oil companies working in Southeast Asia have established headquarters in this 200-square-mile small country. In fact, Singapore has been an oil logistics center in the Pacific for some time, with various kinds of seafaring oil exploration and development barges and equipment being built, assembled, and serviced here. Thus, increased oil exploration in China, Indonesia, Philippines, and other areas during 1978-79 directly affected Singapore's economy.

Table 8.—Singapore: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Oxide and hydroxide	2,795	1,425	All to Malaysia.
Metal including alloys:			
Scrap	3,921	4,228	Japan 3,317; Pakistan 434; Taiwan 420.
Unwrought and semimanufactures	2,256	7,245	Malaysia 1,938; Taiwan 1,460; Philippines 931; North Korea 750.
Chromium oxide and hydroxide	40	66	Malaysia 62.
Cobalt oxide and hydroxide	(1)	3	North Korea 1; Malaysia 1.
Copper:			
Copper sulfate	274	385	Malaysia 317; Japan 30; Thailand 25.
Metal including alloys:			
Scrap	7,531	9,896	India 5,604; Japan 1,518; Republic of Korea 1,284.
Unwrought and semimanufactures	2,293	4,055	Malaysia 2,917; Bangladesh 454.
Iron and steel metal:			
Scrap	6,858	3,745	Malaysia 1,775; Japan 1,151.
Pig iron, ferroalloys, similar materials	4,032	6,143	Malaysia 5,975.
Steel, primary forms	6,579	7,982	Malaysia 6,097.
Semimanufactures:			
Bars, rods, angles, shapes, sections	74,429	122,021	Malaysia 38,421; Hong Kong 28,801.
Universals, plates, sheets	71,809	97,222	Malaysia 63,053.
Hoop and strip	2,214	3,230	Malaysia 3,009.
Rails and accessories	1,643	2,193	Malaysia 1,963.
Wire	2,934	6,807	Malaysia 4,160.
Tubes, pipes, fittings	216,801	259,660	India 192,427; Brunei 14,639; Malaysia 7,160.
Castings	871	438	United Kingdom 196; Brunei 99.
Total	370,701	491,571	
Lead:			
Ore and concentrate	25	34	India 33.
Oxides	37	244	Malaysia 229.
Metal including alloys:			
Scrap	1,699	2,642	Malaysia 1,205; Taiwan 1,199.
Unwrought and semimanufactures	922	632	Malaysia 336; Japan 114.
Manganese:			
Ore and concentrate	12,949	18,501	Thailand 2,365; Malaysia 2,277; Taiwan 2,227; India 2,131.
Oxides	352	596	All to Malaysia.
Mercury 76-pound flasks	56	36	Malaysia 28.
Nickel metal including alloys:			
Scrap	403	409	Japan 328.
Unwrought and semimanufactures	127	159	North Korea 101; Malaysia 57.
Platinum-group metals and silver:			
Waste and sweepings kilograms	8,578	6,126	Japan 3,283; Hong Kong 1,341; United States 1,008.
Metals including alloys:			
Platinum-group troy ounces	418	161	Malaysia 96; United States 64.
Silver do	19,740	73,561	Japan 58,419; Malaysia 7,909; Brunei 1,897.
Tin:			
Ore and concentrate	10,440	8,271	Spain 2,441; U.S.S.R. 2,350; Brazil 1,173.
Metal including alloys:			
Scrap	56	94	Taiwan 40; Malaysia 28; United Kingdom 26.
Unwrought and semimanufactures	3,477	7,876	United States 5,192; Taiwan 472.
Titanium:			
Ore and concentrate kilograms	49	--	
Oxides	281	536	Malaysia 420; Japan 64.
Tungsten:			
Ore and concentrate	131	440	North Korea 293; West Germany 121.
Metal including alloys,, all forms	44	57	United States 37; United Kingdom 6; France 5.
Zinc:			
Ore and concentrate value	$469	$2,444	All to Malaysia.
Oxide and peroxide (except hydroxide)	912	1,277	Japan 704; Malaysia 239; Hong Kong 160.
Metal including alloys:			
Scrap and blue powder	253	734	Taiwan 311; Malaysia 199; Republic of Korea 122.
Unwrought and semimanufactures	4,745	8,331	Malaysia 4,170; Netherlands 2,901.
Other:			
Ores and concentrates of base metals (excluding iron and magnesium)	2	(1)	NA.
Ash and residue containing nonferrous metals	8,959	8,643	Malaysia 1,796; Brunei 1,677; United Arab Emirates 1,393; Bahrain 1,076.
Oxides, hydroxides, peroxides of metals	141	168	Malaysia 97; Brunei 50; United States 10.
Metals including alloys, all forms:			
Metalloids	32	21	All to Malaysia.
Alkali, alkaline-earth, rare-earth metals	2	3	Do.
Base metals including alloys, all forms, n.e.s.	73	228	India 130; Malaysia 71; North Korea 20.

See footnotes at end of table.

Table 8.—Singapore: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	39	30	Malaysia 25.
Grinding and polishing wheels and stones	143	340	Malaysia 223; Burma 74.
Asbestos	5,203	5,901	Malaysia 5,707.
Clays and clay products (including all refractory brick):			
Crude:			
Kaolin	893	1,539	Malaysia 1,163.
Other	15,760	21,716	Philippines 6,536; Brunei 4,381; Malaysia 3,888.
Products:			
Refractory (including nonclay brick)	571	619	Malaysia 527.
Nonrefractory	5,641	10,151	Malaysia 7,779; Brunei 1,337.
Diamond:			
Gem, not set or strung value, thousands	$2,090	$3,846	Hong Kong $1,358; Japan $1,217; Saudi Arabia $601.
Industrial do	$34	$12	Malaysia $6; United Kingdom $4.
Feldspar and fluorspar	5,806	4,008	All to Malaysia.
Fertilizer materials:			
Crude:			
Nitrogenous	1	185	Do.
Phosphatic	22,550	13,019	Malaysia 12,914.
Manufactured:			
Nitrogenous	22,134	50,606	Bangladesh 34,925; Malaysia 13,806.
Phosphatic	3,794	76,065	Bangladesh 45,423; Burma 25,900.
Potassic	196,433	203,616	Malaysia 99,776; Bangladesh 67,405.
Other, including mixed	68,946	97,006	Malaysia 96,053.
Ammonia	349	259	Malaysia 226.
Graphite, natural	7	20	Malaysia 19.
Gypsum and plasters	682	881	Malaysia 723; Taiwan 111.
Lime	3,575	3,811	Papua New Guinea 1,893; Malaysia 745.
Magnesite	114	50	All to Malaysia.
Mica, all forms	80	15	Thailand 12.
Pigments, mineral:			
Natural, crude	29	1	All to Brunei.
Iron oxides, processed	104	339	Malaysia 266.
Precious and semiprecious stones, including synthetic, except diamond value, thousands	$8,601	$19,604	Hong Kong $17,928; Malaysia $518.
Salt	18,146	17,029	Malaysia 12,583.
Sodium and potassium compounds, n.e.s	13,566	12,235	Malaysia 8,543; Philippines 2,576.
Stone, sand and gravel:			
Dimension stone	407	1,162	Malaysia 641.
Dolomite, chiefly refractory grade	11	--	
Gravel and crushed rock	9,040	4,529	Malaysia 2,127; Brunei 1,519.
Limestone	450	681	Malaysia 506; Brunei 175.
Quartz and quartzite	14	([2])	NA.
Sand, excluding metal bearing	1,582	1,640	Brunei 827; United Arab Emirates 351; Australia 200.
Sulfur:			
Elemental:			
Other than colloidal	13,371	14,137	Mainly to Malaysia.
Colloidal	2,075	4,905	Thailand 1,560; Malaysia 1,435; Burma 1,325.
Sulfur dioxide	1	1	All to Malaysia.
Sulfuric acid	2,140	1,458	Sri Lanka 895; Malaysia 411.
Talc, steatite, soapstone, pyrophyllite	1,658	735	Malaysia 638.
Other:			
Crude	42,920	52,937	Malaysia 49,466.
Slag, dross, and similar waste, not metal bearing	634	1,355	Malaysia 1,178.
Oxides and hydroxides of magnesium, strontium, barium	1	12	All to Malaysia.
Bromine, iodine, fluorine value	$5,901	$4,997	Malaysia $3,396; Thailand $1,376.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,527	1,007	Mainly to Malaysia.
Carbon black	678	418	Malaysia 391.
Coal, all grades, including briquets	774	298	Malaysia 110; Philippines 99.
Coke	5,003	7,002	Malaysia 5,612; Burma 1,001.
Hydrogen, helium, rare gases value, thousands	$281	$457	Brunei $130; Taiwan $91; Malaysia $81.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	1,388	665	All to Japan.
Refinery products:			
Gasoline:			
Aviation do	584	467	Australia 143; Papua New Guinea 79; Thailand 50.
Motor do	6,253	8,330	Malaysia 1,394; Australia 1,343; Thailand 928.
Kerosine and jet fuel do	14,927	19,651	United States 4,595; Hong Kong 3,544; India 2,662.
Distillate fuel oil do	24,661	26,884	Thailand 5,009; Australia 3,733; Malaysia 3,472.

See footnotes at end of table.

Table 8.—Singapore: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum —Continued			
Refinery products —Continued			
Residual fuel oil do.	50,202	53,899	Hong Kong 18,656; Japan 12,537; Australia 7,152.
Lubricants do.	3,089	3,158	Thailand 648; Malaysia 592.
Other:			
Naphtha do.	17,922	19,044	Japan 17,314.
Mineral jelly and wax do.	273	294	Republic of Korea 68; Africa 38; India 25; Malaysia 30.
Nonlubricating oils, n.e.s. do.	42	79	Malaysia 36; Saudi Arabia 12.
Pitch and petroleum coke do.	5	4	Philippines 3; Malaysia 1.
Bitumen and bituminous mixtures, n.e.s. do.	1,105	1,368	Australia 222; Bangladesh 210; Iraq 137.
Unspecified do.	7,857	8,441	Kampuchea 6,574; Philippines 1,329.
Total do.	126,920	141,619	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	724	2,915	Malaysia 1,573; Philippines 340.

NA Not available.
[1] Less than 1/2 unit.
[2] Value only reported at $7,474.

Table 9.—Singapore: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Bauxite and concentrate	3,681	7,242	Malaysia 6,840.
Oxide and hydroxide	3,919	4,460	Japan 3,884.
Metal including alloys:			
Scrap	542	399	Malaysia 236.
Unwrought and semimanufactures	17,347	24,221	Japan 3,511; United States 2,4[illegible]; Belgium-Luxembourg 1,259.
Chromium oxide and hydroxide	210	114	West Germany 39; Italy 30; United States 24; U.S.S.R. 15.
Cobalt oxide and hydroxide	(1)	6	Belgium-Luxembourg 4; Thailand 1.
Columbium and tantalum metals kilograms	80	17	Switzerland 12; United States 5.
Copper:			
Ore and concentrate value	$15,203	--	
Metal including alloys:			
Scrap	1,341	1,561	Malaysia 1,089.
Unwrought and semimanufactures	16,849	13,122	Japan 10,010; Australia 2,200.
Iron and steel:			
Ore and concentrate	143,934	16,459	Malaysia 16,179.
Metal:			
Scrap	23,458	92,940	United States 69,029; Brunei 17,995.
Pig iron, including cast iron	7,852	55,807	Taiwan 33,592; India 13,446.
Sponge iron, powder, shot	785	832	United States 535.
Ferroalloys:			
Ferromanganese	110	2,143	Australia 2,073.
Other	2,310	3,920	Australia 3,283.
Steel, primary forms	32,380	63,784	Netherlands 39,948; Japan 15,360; Taiwan 5,871.
Semimanufactures:			
Bars, rods, angles, shapes, sections	256,995	271,509	Japan 111,791; West Germany 50,965; United Kingdom 36,193.
Universals, plates, sheets	431,885	611,548	Japan 519,653.
Hoop and strip	28,772	32,393	Japan 22,640; Australia 4,2[illegible]; Republic of Korea 3,511.
Rails and accessories	7,865	9,275	United States 3,683; Switzerland 2,997; Japan 979.
Wire	11,184	16,787	Japan 6,220; China, mainland 4,902.
Tubes, pipes, fittings[2]	273,355	249,521	Japan 203,574; India 14,802.
Casting and forgings, rough	2,767	6,284	United States 3,079; Japan 2,573.
Total	1,012,823	1,197,317	

See footnotes at end of table.

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Table 9.—Singapore: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Lead:			
Ore and concentrate	15	38	Morocco 35.
Oxides	695	589	Australia 458.
Metal including alloys:			
Scrap	166	664	Australia 491.
Unwrought	3,946	4,560	Australia 3,485; Malaysia 659.
Semimanufactures	702	695	Australia 383; Taiwan 60.
Magnesium metal including alloys, unwrought and semimanufactures	15	47	United Kingdom 33; United States 9.
Manganese:			
Ore and concentrate	21,820	44,980	Africa, n.e.s., 24,962; Ghana 20,003.
Oxides	1,254	2,319	Ireland 1,477; Japan 520.
Mercury 76-pound flasks	10	121	China, mainland, 50; Italy 44.
Molybdenum metal including alloys, all forms	11	8	Austria 4; United States 3.
Nickel metal including alloys:			
Scrap	39	31	Malaysia 26.
Unwrought and semimanufactures	361	517	Japan 202; Canada 161.
Platinum-group metals and silver:			
Platinum-group troy ounces	13,664	1,414	United States 707; United Kingdom 386.
Silver do	423,296	687,832	Australia 237,369; West Germany 184,641; United States 139,470.
Tin:			
Ore and concentrate	3,177	3,118	Thailand 2,362; Burma 733.
Oxides	4	4	Malaysia 3; Thailand 1.
Metal including alloys:			
Scrap	43	60	Japan 37; Malaysia 23.
Unwrought and semimanufactures	986	1,774	Malaysia 1,019; Hong Kong 305.
Titanium:			
Ore and concentrate	93	55	All from Australia.
Oxides	3,882	3,420	Japan 729; Australia 704; West Germany 477; United Kingdom 432.
Tungsten:			
Ore and concentrate	67	405	Thailand 343; Burma 61.
Metal including alloys, all forms	42	54	Japan 24; Austria 18; Republic of Korea 7.
Zinc:			
Ore and concentrate value	$364	$240	All from United Kingdom.
Oxide and peroxide (except hydroxide)	312	432	Netherlands 166; United Kingdom 91.
Metal including alloys:			
Scrap	483	403	Malaysia 343.
Blue powder	259	405	Australia 214; United States 89; United Kingdom 65.
Unwrought and semimanufactures	13,953	18,253	Canada 5,870; North Korea 4,151; Australia 2,552; Republic of Korea 2,007.
Zircon	107	155	Australia 119.
Other:			
Ash and residue containing nonferrous metals	60,994	37,380	Japan 36,955.
Oxides, hydroxides, peroxides of metals	417	432	Norway 130; West Germany 65; United Kingdom 64.
Metals including alloys, all forms:			
Metalloids	14	21	Japan 18.
Alkali, alkaline-earth, rare-earth metals	11	39	France 35; United States 4.
Pyrophoric alloys	59	33	China, mainland, 21; Austria 9.
Base metals including alloys, all forms, n.e.s	55	321	China, mainland, 263; Italy 28.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	175	221	United States 85; Italy 35; Japan 30; Malaysia 22.
Dust and powder of precious and semiprecious stones value	$4,450	$2,365	Malaysia $1,296; United States $512.
Grinding and polishing wheels and stones	842	1,239	Japan 451; Taiwan 247; Italy 246.
Asbestos	13,376	9,168	Africa 5,248; Australia 2,793.
Cement thousand tons	1,449	1,636	Japan 1,114; Republic of Korea 293; Taiwan 167.
Clays and clay products (including all refractory brick):			
Crude:			
Kaolin	4,925	4,802	Malaysia 3,391; Japan 947.
Other	23,373	50,742	United States 38,766; Malaysia 6,634.

See footnotes at end of table.

Table 9.—Singapore: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Clays and clay products (including all refractory brick) —Continued			
Crude —Continued			
Products:			
Refractory (including nonclay brick)	10,710	10,411	China, mainland, 3,988; United Kingdom 2,141; Japan 1,874.
Nonrefractory[3]	67,182	67,095	Italy 32,450; Japan 13,597.
Diamond:			
Gem, not set or strung ..... value, thousands	$9,217	$21,925	Israel $7,718; India $4,163; Netherlands $3,980.
Industrial ..... do	$184	$282	Belgium-Luxembourg $277.
Diatomite and other infusorial earth	339	320	United States 242; Philippines 47.
Feldspar and fluorspar	6,623	5,503	India 4,877.
Fertilizer materials:			
Crude, phosphatic	26,071	14,108	Christmas Island 12,030; Sri Lanka 1,700.
Manufactured:			
Nitrogenous	27,559	74,484	United States 41,364; U.S.S.R. 7,000; North Korea 5,250.
Phosphatic	46,241	115,575	United States 69,688; Morocco 40,737.
Potassic	260,396	247,697	Canada 158,624; West Germany 53,428; Israel 28,193.
Other, including mixed	65,398	105,879	West Germany 94,846; Belgium-Luxembourg 5,440; United States 5,292.
Ammonia	387	409	Malaysia 188; Japan 163.
Graphite, natural	162	151	Sri Lanka 82; Japan 27; United Kingdom 17.
Gypsum and plasters	53,708	71,003	Hong Kong 52,554; Australia 16,196.
Lime	16,733	16,293	Malaysia 16,113.
Magnesite	97	180	Norway 103.
Mica, all forms	711	318	United Kingdom 147; Australia 112.
Pigments, mineral:			
Natural, crude	304	136	Japan 101.
Iron oxides, processed	1,336	1,686	West Germany 681; China, mainland, 539.
Precious and semiprecious stones, except diamond, worked and unworked:			
Natural ..... value, thousands	$12,290	$17,196	Japan $11,042; Hong Kong $1,769; Sri Lanka $1,444.
Manufactured ..... do	$194	$247	Thailand $69; India $57; Hong Kong $55.
Salt and brines	52,090	50,993	Thailand 27,733; Australia 12,499.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	9,065	13,653	United States 3,779; France 3,518; Romania 3,181.
Caustic potash and sodic and potassic peroxides	568	800	Poland 211; Hong Kong 190; Japan 134.

See footnotes at end of table.

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Table 9.—Singapore: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS —Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	1,918	8,330	Malaysia 7,206.
Worked	12,704	15,750	Italy 10,693; China, mainland, 3,145.
Dolomite, chiefly refractory grade	3,019	2,930	Malaysia 2,787.
Gravel and crushed rock	566,231	679,779	Republic of Korea 674,056.
Limestone, except dimension	26,816	31,091	United Kingdom 30,845.
Quartz and quartzite	2,460	2,527	Malaysia 2,362.
Sand, excluding metal bearing	222,798	277,342	Malaysia 272,792.
Sulfur:			
Elemental:			
Other than colloidal	188	373	Taiwan 182; Australia 59; West Germany 54.
Colloidal	362	315	Thailand 110; United States 102.
Sulfur dioxide	1	7	United Kingdom 6.
Sulfuric acid	98	74	United States 48; United Kingdom 15.
Talc, steatite, soapstone, pyrophyllite	8,746	6,054	China, mainland, 3,781; Republic of Korea 1,102.
Other:			
Crude	79,315	99,689	West Germany 85,420; United States 6,844; Taiwan 6,656.
Slag, dross, and similar waste, not metal bearing	2,551	2,653	Africa 1,144; China: Mainland 682 and Taiwan 560.
Bromine, iodine, fluorine value	$45,608	$21,312	West Germany $7,343; Japan $4,901; United Kingdom $4,383.
Oxides and hydroxides of magnesium, strontium, barium	235	109	West Germany 49; Japan 40.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	3,485	3,557	Malaysia 1,654; Italy 513; Japan 297.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,142	1,318	Republic of Korea 885; Thailand 150; United States 146.
Carbon black	3,716	4,664	Japan 1,827; Malaysia 1,073; Australia 1,328.
Coal, all grades, including briquets	726	2,345	United States 2,320.
Coke	11,030	12,796	Japan 7,620; Netherlands 3,000; Taiwan 2,122.
Hydrogen, helium, rare gases value, thousands	$351	$445	United Kingdom $143; United States $128; Japan $62.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	173,764	203,463	Saudi Arabia 126,850; Iraq 24,544; Iran 22,985.
Refinery products:			
Gasoline:			
Aviation do	651	503	Iran 367; Netherlands 136.
Motor do	896	147	Bahrain 137.
Jet fuel do	194	([4])	NA.
Kerosine do	814	524	Malaysia 191; Japan 154; U.S.S.R. 148.
Distillate fuel oil do	3,510	1,807	Bahrain 1,095, Australia 518.
Residual fuel oil do	22,373	16,933	Bahrain 7,220; Iran 3,843; Kenya 2,054; Malaysia 672.
Lubricants do	775	738	Australia 207; Netherlands Antilles 146; Malaysia 137.
Other:			
Nonlubricating oils, n.e.s do	38	44	United States 10; Malaysia 8; United Kingdom 5.
Mineral jelly and wax do	39	35	France 15; China, mainland, 12.
Pitch and petroleum coke do	26	27	United States 12; West Germany 5.
Bitumen and bituminous mixtures, n.e.s do	16	15	Thailand 7; United States 3.
Other do	1,582	3,383	Malaysia 1,187; Australia 651; Kuwait 387.
Total do	30,914	24,156	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals[5]	8,496	3,098	Australia 1,740; United Kingdom 1,070.

NA Not available.

[1] Less than 1/2 unit.

[2] Figures exclude quantities valued at $1,549,891 in 1977 and $1,599,515 in 1978.

[3] Figures exclude quantities of brick of baked clay valued at $1,043,785 in 1977 and $505,548 in 1978.

[4] Value only reported at $218.

[5] Figures exclude quantities valued at $31 in 1977 and $1,801 in 1978.

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SRI LANKA[41]

Sri Lanka was one of the world's major suppliers of gem stones (excluding diamond) and ranked sixth in world production of natural graphite during 1978 and 1979. Titanium minerals, industrial clays, and limestone were also produced but were important to the local economy and not significant on the world market.

The search for petroleum failed to discover any commercial deposits despite extensive surveys and several exploratory wells drilled onshore and offshore. Under a Norwegian Government grant, a review is underway of all geophysical data to determine the advisability of further exploration.

The mineral industry accounts for about 2% of the gross domestic product (GDP), and around 6% of total exports.

The new United National Party Government, elected overwhelmingly in the July 1977 elections, launched a comprehensive program to reform the economy and accelerate economic growth during 1978. Various policy changes started the process of freeing the economy from excessive controls and shifting Government spending from consumer subsidies to capital investment. The changes included unification and devaluation of the dual exchange rate, relaxation of import and most price controls, changes in the food subsidy program, and elimination of some Government monopolies to allow more private sector competition. The 1979 budget introduced tax reform to promote savings and capital investment.

As a result of the Government's efforts, the gross national product (GNP) rose 8.2% in 1978 in real terms, to rupees 36 billion,[42] the highest economic growth rate since 1968 and more than twice the average annual growth during the past decade.[43] The output of the industrial sector was slightly higher, expanding 11% in real terms in 1978.

As a result of the import liberalization program, raw materials and spare parts became readily available, and overall capacity utilization rose from 61% in 1977 to 70% in 1978. Major areas of growth were in basic metals, textiles, nonmetallic minerals, paper, and chemicals.

Good weather contributed to record rice crops in 1977 and 1978, aiding the economy in the important agricultural sector.

Concomitant with the favorable economic factors were the problems of inflation and unemployment. The Central Bank estimated the average rate of inflation in 1978 was between 15% and 16%, lower than the 16% to 20% estimated for 1977. Based on published indices, wages of private sector workers kept pace with inflation in 1978; workers' salaries in the public sector, however, showed a drop in real wages.

Unemployment continued to be a major problem in the economy, but the 20% level of the mid-1970's was apparently being reduced during 1978 and 1979 by the new or accelerated Government programs. The Central Bank estimated that unemployment was down to 900,000 in 1978, or 16% of the labor force of about 5.6 million. In order to create jobs as quickly as possible, the new Government began concentrating on three major development projects: (1) acceleration of the Mahaweli River irrigation system, (2) the establishment of a free trade zone north of Colombo, and (3) urban renewal of the greater Colombo area. The Mahaweli project is a series of dams, canals, and hydroelectric stations to more than double the amount of irrigated land in the country and greatly increase hydroelectric capacity. Work had been progressing slowly under the former plan and the project will now be implemented more quickly, in part by increased foreign aid commitments.

Economic progress in 1979 was not as dramatic as in 1978 because the industries were operating closer to installed capacity, and scarcities of skilled labor, construction materials, and other inputs began to appear. With continued good weather resulting in increased crop yields, Sri Lanka was predicted to sustain a real growth rate of around 5% to 6% through yearend 1979. By the end of September, the Colombo consumer price index was up 12% over the December 1978 level, while the corresponding increase in the Central Bank index was 20%. Price increases for foreign oil forced the Government-owned Ceylon Petroleum Corp. to raise consumer fuel prices in mid-1979. Some formerly subsidized products doubled or trebled in price, reinforcing inflationary pressures.[44]

PRODUCTION AND TRADE

Mineral production generally increased during 1978. A large increase in rutile and zircon production resulted from the completion and opening of the rebuilt mineral sands production facility at Pulmoddai.

Exports of gems, graphite, titanium minerals, and zircon increased in 1978. Exports of the titanium minerals in 1979 will be dependent more on market conditions than production capability.

The major mineral import was crude oil to supply the needs of the country's refinery. Crude oil or natural gas was not produced domestically. The cost of the imported oil reached rupees 2.2 billion in 1978 and will reflect world price changes in 1979. A small amount of the lighter petroleum products was also imported.

COMMODITY REVIEW

Gem minerals accounted for about three-fourths of the total value of mining output. However, the rapid rise in the value of exports, up 100% in the mid-1970's, slowed considerably in 1978. With the Government's elimination of the special foreign exchange bonuses for gem exporters in November 1977, a significant portion of gem production was believed to be smuggled out of the country and not reflected in official trade figures. The total value of gem production reported in 1978 was estimated at over rupees 526 million. This was a large rupee increase over the 1977 figure. Data for 1979 were not available.

Sapphire, ruby, cat's-eye, and alexandrite were the main stones produced. Clear deep blue sapphire accounted for the most value followed by star sapphire and cat's-eye. Japan, Hong Kong, Switzerland, and the United States were the major importers of the Sri Lankan stones. Most of the stones are cut and polished for jewelry but a small amount also are used in precision instruments and in the watch industry.

The twenty-year-old ban on diamond imports was removed in 1977 and the country's first diamond lapidary opened during 1978 at Seeduwa, 25 kilometers outside of Colombo. The privately owned shop, equipped with sophisticated grinding and polishing instruments, will import rough diamonds from Belgium and export finished gems. European experts staff the facility and are training Sri Lankans in cutting and polishing. The plant will employ about 150 workers.

The Government has reportedly invited local and foreign firms to examine areas to be flooded by the dams constructed during the implementation of the Mahaweli development project to mine out any gem discoveries prior to the flooding. Some of the areas to be inundated are believed to contain rich deposits of gem stones.

The second most valuable mineral-derived product in 1978 was cement. Production increased significantly in response to higher demand from the construction industry but was still well below the present 710,000-ton-per-year design capacity of the country's three plants. The favorable production trend continued during 1979.

Production of titanium minerals and zircon from the rich Pulmoddai mineral sands deposit showed a large increase with the commissioning of the Ceylon Mineral Sands Corp.'s (CMSC) new rutile-zircon plant in early 1978. The plant began trial production in December 1977 and was expected to reach optimum production by the middle of 1978 following the normal shake-down period. The ilmenite section of the plant was not operated in late 1977 and early 1978 because of a 20,000-ton stockpile of unsold ilmenite. CMSC officials were scheduled to negotiate future sales contracts in Japan.

Under a second phase expansion targeted for 1985, ilmenite capacity will be raised to 130,000 tons per year from 230,000 tons per year of raw sand.

The Sri Lankan Government was interested in increasing export earnings from Pulmoddai by further processing ilmenite. Possibilities include a plant producing titania slag and byproduct pig iron or a titanium dioxide plant. Tenders for a titanium dioxide plant have been invited.

Currently the capacity of the CMSC facility is 85,000 tons of ilmenite, 12,000 tons of rutile, and 5,000 tons of zircon per year. About 300 tons per year of crude monazite concentrate also was recovered as a byproduct and stockpiled. Reserves at the Pulmoddai deposit were put at 3.2 million tons of sands grading over 30% heavy minerals.

Both the value and quantity of graphite produced in 1978 increased substantially, but graphite dropped from second to third place in value of mineral exports because of the increase in titanium mineral exports.

Exports to the United States totaled over 2,000 metric tons, valued at more than $1.1 million. This represented an increase both in tonnage and value of 30% and 184%, respectively, compared with 1977 shipments.[45]

A countrywide search for radioactive minerals was undertaken by the Sri Lankan Geological Survey in 1979 under an International Atomic Energy Agency program. It entailed stream sediment sampling and investigation of other heavy mineral deposits, mainly the beach sands of coastal areas.[46]

In 1979 the Asian Development Bank

approved an additional loan to finance continuing construction of the 147,000-ton-per-year (N) urea plant at Sapugaskanda. The cost of the project has escalated to at least $171 million. Completion was set for early 1980.

The Government was actively encouraging foreign participation in its oil exploration program. About 5,000 kilometers of geophysical survey lines have been completed and a Norwegian consortium was to assist the state oil company in an offshore search. The initial work will be a detailed analysis of the offshore geology to determine if drilling is warranted. Ten shallow water and two deep water exploration blocks were available for production sharing contracts.

Expansion of the Ceylon Petroleum Corp.'s refinery at Sapugaskanda was scheduled for completion by early 1979 and was designed to increase production of light distillates, particularly naphtha, which will be the feedstock to the fertilizer plant. The company planned an additional expansion costing $80-$100 million in the form of a sophisticated hydrocracking complex, and tenders were solicited from contractors in several countries. In September 1979, however, the Government reportedly rejected all of the tenders received.

Sri Lanka continued to be dependent on imported oil for its fuel needs. During 1978 Saudi Arabia supplied 65% of the crude imports and Iran the remainder. In 1979 the sources of supply were more diversified and reportedly included Oman, Iraq, Libya, and China in addition to the 1978 suppliers. Exports of surplus naphtha and bunker oil brought a return of over $17 million in 1978.

Table 10.—Sri Lanka: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS		
Aluminum metal including alloys, all forms	3	(1)
Copper metal including alloys, all forms value	$553	[illegible]
Gold metal, unworked or partly worked do	$5,164	--
Iron and steel metal including alloys, all forms	1,211	17
Lead:		
Oxides	478	[illegible]
Metal including alloys, all forms	235	71
Platinum-group metals including alloys, all forms value	$1,076	--
Silver metal including alloys, all forms troy ounces	17,233	[illegible]
Other: Ores and concentrates	39,996	[illegible]
NONMETALS		
Cement	300	[illegible]
Clays and clay products (including all refractory brick)	3,535	[illegible]
Fertilizer materials, crude and manufactured	374	471
Graphite, natural	8,059	[illegible]
Mica, including splittings and waste	149	[illegible]
Precious and semiprecious stones, unspecified carats	1,648,822	[illegible]
Salt	9,295	[illegible]
Stone and sand, excluding metal bearing	442	[illegible]
Other: Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	274	234
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural kilograms	744	--
Gas, hydrocarbon do	1,671	[illegible]
Petroleum refinery products:		
Nonbunker, all types thousand 42-gallon barrels	269	[illegible]
Bunkers:		
Jet fuel do	547	[illegible]
Distillate fuel oil do	589	[illegible]
Residual fuel oil do	2,474	[illegible]
Lubricants do	5	6
Total do	3,884	[illegible]
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	101,221	[illegible]

[1] Less than 1/2 unit.

Table 11.—Sri Lanka: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978
METALS		
Aluminum:		
Oxide and hydroxide	42	30
Metal including alloys, all forms	2,175	3,972
Arsenic:		
Natural sulfides kilograms	2,000	--
Trioxide, pentoxide, acids do	4,961	10
Copper:		
Copper sulfate	8	NA
Metal including alloys, all forms	1,222	990
Gold metal, unworked or partly worked thousand troy ounces	--	(1)
Iron and steel metal:		
Scrap	(2)	--
Pig iron, ferroalloys, similar materials	267	210
Steel, primary forms	19,067	24,756
Semimanufactures	174,511	70,334
Lead metal including alloys, all forms	483	885
Manganese:		
Ore and concentrate	NA	2,101
Oxides	66	235
Mercury 76 pound flasks	171	476
Nickel metal including alloys, all forms	6	6
Silver metal including alloys, all forms troy ounces	6,494	2,122
Tin metal including alloys, all forms	315	83
Titanium oxides	108	76
Tungsten metal including alloys, all forms kilograms	445	300
Zinc:		
Oxide	371	925
Metal including alloys, all forms	30,272	568
Other:		
Ores and concentrates	944	1
Oxides, hydroxides, peroxides of metals	19	74
Metals:		
Alkali, alkaline-earth, rare-earth metals kilograms	2,086	132
Pyrophoric alloys do	21	79
Base metals including alloys, all forms, n.e.s	25	4
NONMETALS		
Abrasives, natural	75	213
Asbestos	2,296	1,940
Barite and witherite	(2)	30
Boron oxide and acid	59	21
Cement	247	7,228
Chalk	(2)	213
Clays and clay products (including all refractory brick):		
Crude	1,028	1,519
Products:		
Refractory	751	2,876
Nonrefractory	39	11
Diamond, gem, not set or strung carats	1,928	193,888
Diatomite and other infusorial earth	10	3,834
Feldspar and fluorspar	--	16
Fertilizer materials:		
Crude	(2)	6
Manufactured:		
Nitrogenous	27,605	83,311
Phosphatic	4,200	44,530
Potassic	(2)	20,780
Other, including mixed	103	56
Ammonia	93	157
Gypsum and plasters	10,453	988
Lime	(2)	130
Magnesite	(2)	31
Mica, all grades	(2)	8
Pigments, mineral, including processed iron oxides	21	652
Precious and semiprecious stones, excluding diamond carats	2,439	102,725
Pyrite, gross weight	--	51
Salt	10	21
Sodium and potassium compounds:		
Caustic soda	6,450	78,446
Caustic potash	47	43
Stone, sand and gravel	99	143
Sulfur:		
Elemental:		
Other than colloidal	46	143
Colloidal	382	586
Sulfur dioxide	5	(2)
Sulfuric acid	523	612
Talc, steatite, soapstone, pyrophyllite	1,077	1,310

See footnotes at end of table.

Table 11.—Sri Lanka: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978
NONMETALS —Continued		
Other:		
Crude	2,502	5,593
Oxides and hydroxides of magnesium, strontium, barium	6	9
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	7	24
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	27	2
Carbon black and gas carbon	1,715	[illegible]
Coal, all types, including briquets	150	484
Coke and semicoke	629	12,391
Hydrogen, helium, rare gases	7	42
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	11,245	11,142
Refinery products:		
Gasoline do	28	[illegible]
Kerosine and jet fuel do	310	118
Distillate fuel oil do	269	221
Lubricants do	10	41
Other do	186	428
Total do	803	[illegible]
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	294	124

NA Not available.

[1] Official trade statistics of Sri Lanka report substantial imports of several classes of gold, but the corresponding values reported suggest that 1) the material is not pure gold, 2) the quantitative unit is incorrectly reported, and/or 3) the values are substantially in error.

[2] Less than 1/2 unit.

VIETNAM[47]

During 1978-79 Vietnam produced a modest amount of at least a dozen minerals, including antimony, iron ore, clays, zinc, copper, hydraulic cement, building stone, salt, coal, phosphate rock, tin, and chromite. The last four were produced in sufficient amounts that a surplus was available for export. In addition, deposits of bauxite, graphite, lead, manganese, silver, and titanium were known to occur within the country. The mining sector generally accounts for about 5% of gross national product. In the overall picture though, Vietnam was not a major world producer of any mineral commodity. Data on mineral production are seldom specific, often conflicting or ambiguous and frequently stated in terms of percent increase over an unstated or unknown base period. Mineral data was particularly scarce during 1979 because the Vietnamese press was largely preoccupied with the reporting of political and military events.

Vietnam's economy, particularly the agricultural sector, was adversely affected by three successive years of droughts, floods, typhoon, insect pests, and unseasonal temperatures.

The economy was further hurt in July 1978 when the Chinese withdrew all of their advisors and technical experts from projects they were helping to develop with the Vietnamese. Some large coal mine projects in particular were set back as a result.

The year 1979 began with Vietnam being involved in military activity in Kampuchea and then in February the Chinese crossed the northern border in an attack on Vietnam.[48] During the short campaign, Chinese troops penetrated up to 40 kilometers inside Vietnam. The attack reportedly destroyed over 1 million square meters of housing space, bridges, factories, and railroad lines and damaged some important mines. These included the rock phosphate and iron ore mines near Lao Cai, and tin, copper, and chromite mines in the Lang Son and Cao Bang areas.

Economic plans were further disrupted by the diversion of enormous amounts of manpower and resources from industry and agriculture to the military effort. Shortages of fuel and trucks caused transportation problems and affected movement of goods intended for the export market.

On the industrial scene, the 1978 output grew by 7% compared with a target of 21%. As a result, the 1979 target was reduced to a more feasible 12%. It was doubtful, however, if this was achieved, in light of the difficulties already mentioned. In addition, the exodus of tens of thousands of refugees, many of them skilled ethnic Chinese, affected production in the coal mines and hence the generation of electric power and the overall industrial output.

The Government had planned to construct 4 million square meters of housing during 1978 but only about 1.5 million square meters were actually completed. The 1979 plan was cut back to 1 million square meters, but because of a large amount of defense-related construction after the border conflict, it was doubtful that even that reduced target was achieved.

The 1980 state plan, adopted at the Sixth Socialist Republic of Vietnam National Assembly, called for a 4.7% increase in total industrial output value over that of 1979, and an 11% increase in total agricultural output in the same period. Other goals in the 1980 plan included an increase of 14% in coal and cast iron, 30% in cement, and 32% in both phosphate and nitrogenous fertilizer.

The state plan called for total capital investments to be increased by 2.2% over that of 1979. Much of the new construction will be directed toward improving the agricultural sector. In addition, emphasis will be placed on increasing the output and capacity of electric power, cement, and fertilizer, all of which will indirectly benefit the agricultural output.

Despite their many problems, the Vietnamese did manage to engage in foreign trade with both Council for Mutual Economic Assistance and market economy nations in 1978 and 1979. The total value of merchandise exports reportedly amounted to about $482 million in 1978 and was planned to increase by 31% in 1979. Limited data for the first quarter of 1979, however, indicated a considerable decline in both volume and value of exports over the same period in 1978. Exports to Japan, the major market economy trade partner, showed a 32% drop during that period. Vietnam's chief export was high-quality coal. Approximately 900,000 tons were shipped in 1977 and 460,000 tons in 1978, mostly to Japan. Vietnam has been also a substantial exporter of phosphate rock. However, the quantities shipped and the current destinations are not available.

Merchandise imports during 1978 totaled about $1.16 billion and were estimated to increase to $1.20 billion in 1979.[49] Approximately one-third of the 1978 total was for food grain imports and most of the remainder was for fuels and raw materials.

COMMODITY REVIEW

Vietnam produces a modest amount of steel from domestically mined raw materials. Iron ore was mined at the Trai Cau mine in Bac Thai Province and smelted at the Thai Nguyen steelworks. The new Luu Xa rolling mill, using billets from Thai Nguyen, probably began operating during 1977. In 1978 the plant forged its own rollers, the first ever made in Vietnam. In addition, the older Gia Sang rolling mill underwent a complete overhauling and expansion during August and September of 1978. Planned capacity of the refurbished mill was to be 50,000 tons of rolled steel per year. The rolling mills comprised one of the few major industries that reportedly met their quotas in 1978 and 1979. In addition to domestic production, Vietnam has a three-year agreement with Japan to buy 200,000 tons per year of rolled steel products through 1980.

The most important development in the iron and steel sector during 1978 and 1979 was the abandonment of the planned construction of an integrated steel complex at the Thai Nguyen steel plant. The French firm Creusot Loire had completed a feasibility study and was ready to send the first shipment of equipment for the project, which would have expanded and modernized the primitive steelmaking facilities at Thai Nguyen. In the agreement the Vietnamese were to provide the necessary infrastructure, which involved site preparation at the plant, finding suitable ore deposits, building a railroad to transport ore to the plant, and building roads and bridges capable of handling the bulky and heavy equipment that would be transshipped from the port of Haiphong to the site. When Creusot Loire was ready to begin deliveries in mid-1978, Hanoi reported that their part of the work had not been started. Reportedly, Creusot Loire withdrew from the project, highlighting the country's infrastructure weakness, its managerial problems, and its inability to absorb large quantities of technological aid.[50]

Expansion of the steel production capacity continued to warrant priority on the Government's industrial development plan. The Thai Nguyen modernization will probably be revived as soon as the overall conditions are favorable enough to allow construction of the required support facilities.

The Vietnamese continued with their enterprising plans to increase cement production despite problems in other economic sectors. The Ha Tien and Haiphong plants were the only rotary-kiln cement mills operating during 1978 and 1979. Three large foreign engineered plants were under construction during the period.

The 1.2-million-ton-per-year plant at Binh Son in Thanh Hoa Province was being built with Soviet aid. The tube for the rotary kiln was nearly assembled by late autumn of 1979. The plant could be ready for production by late 1980 or early 1981 if no problems arise. The construction activity employs 14,000 workers.

The Hoang Thach plant in Hai Hung province is under construction with Danish and Japanese aid. The dry process, computer controlled plant will have a designed capacity of 3,100 tons per day. Installation of the kiln was completed in August 1979. Support equipment was at the mid-stage of assembly at that time.

The third major project was a French-aided, 1.0-million-ton-per-year expansion of the Kien Luong plant at Ha Tien in the southwest corner of Vietnam. The plant is scheduled for completion in 1980.

Of more immediate benefit to the economy was the construction of small vertical kiln plants with capacities ranging from 5,000 to 20,000 tons per year. The state plan called for completion of 26 such plants during 1977 and 1978. Plants which were reported to have begun operating by late 1979 were located in Uong Tu, Quang Ninh Province; Thai Nguyen, Bac Thai Province; Dong Vinh, Thanh Hoa Province; Long Tho, Binh Tri Thien Province; Da Nang, Quang Nam-Da Nang Province; Dieu Tri, Nghia Binh Province; Hon Khoi, Phu Khanh Province; and Ho Chih Minh City. Status of the other planned plants was not reported in the press. These small plants were inexpensive to build and use local raw materials to supply cement for the local building industry. Collectively output by the small plants will help relieve the current cement shortage until the big rotary kiln plants come onstream with their more uniform and higher quality product.

The Government has placed a priority on the expansion and modernization of the fertilizer industry in order to support increased agricultural output and maintain phosphate exports. Vietnam has large deposits of phosphate ores, with major production coming from the Lao Cai mine near the northwest border. Vietnamese sources indicated that present exploitation of the apatite deposits was not being done in an efficient manner and that large amounts of usable ore were being wasted during mining of the high-grade ores. Little or no beneficiation was done on the ores.[31]

Most of the domestic mine production goes to small plants that grind the ore for direct application. Some of these plants have roasting facilities to increase the solubility of the phosphate before grinding. In addition, there are a few plants producing a modest amount of single superphosphate fertilizer. A published account of 271,000 tons of fertilizer produced in the first half of 1978 may refer to gross weight of superphosphate for that period.[32]

Toward the goal of increasing fertilizer production, the Government commissioned seven new fertilizer factories (phosphate grinding plants) between January and October 1978. At least three of these had grinding capacities of 40,000 tons per year each, and were located in Ninh Binh, Hai Hung, and Nghe Tinh. Overall, the mining and grinding capacity of the fertilizer sector progressed as planned during 1978 but serious transportation problems limited the production increases to very modest levels.

Plans called for the production of 1.3 million tons per year of phosphate fertilizer (grade not specified) by 1980. This was to be accomplished by expansion of the Lao Cai mine to a production of 1.5 to 3.0 million tons per year of ore grading 32% to 34% P_2O_5 content. This would leave a surplus for a significant increase in the amount of exports.

The Government's expansion plans were disrupted by the occupation of the Lao Cai mine. Vietnamese press reports and photos released after the withdrawal claimed that the mining equipment had been systematically destroyed. In addition, the Lao Cai and Pha Ta powerplants were also reportedly destroyed.

The 1979 fertilizer production was certainly affected by these events and the [illegible] output could be affected as well. The mining equipment will be difficult and expensive to repair or replace; Vietnam does not manufacture large shovels or earthmoving equipment and will therefore be dependent on the U.S.S.R. or other foreign countries for replacements. The long-term production loss will depend on how much equipment was actually destroyed, how much could be salvaged, and how quickly replacements [illegible] obtained.

Vietnam had planned to produce 10 million tons of washed coal during 1980. Events during 1978-79 have probably set that goal back at least one year and possibly two.

The Vietnamese claimed that work on new mines continued without serious difficulties, however, two months after the Chinese departure, Vietnam signed a coal mining cooperation accord with the U.S.S.R. No details were released.

On the natural scene, heavy rain caused at least one major mine to be inundated in 1978. Pumping of the lower levels continued well into 1979.

Another serious hindrance to increased coal production was the failure of the Government to plan for a balanced and rational system of moving the coal once it was mined, to maintain the new mining and transportation equipment, and to train sufficient technicians, miners, and mechanics to sustain the level of necessary work.

In late 1978, before the hostilities, labor was recruited on an emergency basis to try to increase or at least maintain the production and in particular the movement of the coal. Production apparently did increase during the last two months of 1978 but not enough to achieve the 1978 goal of 7.0 million tons of washed coal. The Government admitted to an 800,000-ton shortfall in 1978. There was little improvement during 1979 although a number of mines of widely varying capacity were nearing completion or producing some coal from development drifts or shaft construction. The Government's 1980 revised industrial plan called for a 14% increase in coal production over the 1979 output.

During 1978 Hanoi granted service contracts to three foreign exploration groups: Bow Valley Industries Ltd., a Canadian consortium; AGIP, the exploration subsidiary of Italy's ENI; and the West German company Deminex Deutsche Erdol Versergungsgesellschaft MBH. Negotiations to finalize an earlier protocol signed by Elf Aquitaine of France apparently were not successful.

Table 12.—Vietnam: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum metal including alloys:			
Unwrought	798	999	All from Japan.
Semimanufactures	2,121	1,311	Japan 843; Hungary 491.
Copper metal including alloys:			
Unwrought	1,696	--	
Semimanufactures	440	218	Japan 217.
Iron and steel metal:			
Pig iron	--	16,300	All from Japan.
Ferroalloys	700	900	All from U.S.S.R.[2]
Semimanufactures:			
Bars, rods, angles, shapes, sections	159,418	162,674	Japan 90,610; U.S.S.R. 60,000.[2]
Plates and sheets	89,830	106,140	Japan 100,931; Hungary 2,514.
Hoop and strip	2,662	2,122	Japan 2,109.
Rails and accessories	525	4	All from Japan.
Wire	17,002	15,157	Japan 13,721; Sweden 750; Netherlands 630.
Tubes, pipes, fittings	11,100	12,038	Japan 6,908; U.S.S.R. 3,500;[2] France 654.
Castings and forgings	--	1,457	France 1,240.
Lead metal including alloys:			
Unwrought	--	1	All from Japan.
Semimanufactures	--	51	Japan 50.
Manganese oxides	800	501	All from Japan.
Molybdenum metal including alloys, all forms	1	--	
Nickel metal including alloys, semimanufactures	4	--	
Silver metal, unworked or partly worked value, thousands	$26	$25	Do.
Tin metal including alloys, semimanufactures	--	2	All from France.
Titanium oxides	310	100	All from Japan.
Tungsten metal including alloys, all forms	--	1	Do.
Zinc:			
Oxide and peroxide	250	--	
Metal including alloys:			
Unwrought	1,890	--	
Semimanufactures	--	67	Japan 66.
Other:			
Ores and concentrates	--	200	All from Japan.
Oxides, hydroxides, peroxides	53	94	Do.
Metalloids	--	54	Japan 30; France 24.

See footnotes at end of table.

Table 12.—Vietnam: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
NONMETALS			
Abrasives: Grinding and polishing stones	75	1	All from Japan.
Boron oxide and acid	98	--	
Cement	181,770	194,534	U.S.S.R. 111,000; Japan 67,48
Clays and clay products:			
Crude	--	9	All from France.
Products:			
Refractory	7,628	500	Japan 414; Hungary 86.
Nonrefractory	486	74	Singapore 40; Italy 34.
Diatomite and other infusorial earth	--	60	All from Japan.
Feldspar and fluorspar	650	302	Do.
Fertilizer materials:			
Manufactured:			
Nitrogenous	162,312	175,729	Japan 86,059; U.S.S.R. 77,6[illegible]; Indonesia 10,000.
Potassic	21,600	15,984	All from U.S.S.R.
Other, including mixed	1	31	Singapore 25.
Ammonia	206	4	All from Denmark.
Gypsum and plasters	NA	4,100	All from Thailand.
Mica, worked	9	5	All from Japan.
Pigments, mineral: Iron oxides, processed	210	1	Do.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	5,100	7,395	U.S.S.R. 5,300[2]; West Germany 2,095.
Caustic potash	--	30	All from Japan.
Soda ash	4,300	5,000	All from U.S.S.R.[2]
Stone, sand and gravel:			
Quartz and quartzite	--	2	All from Japan.
Sand, not metal bearing	1,165	243	All from Sweden.
Other	--	106	Sweden 105.
Sulfur, elemental, colloidal	--	110	Japan 100.
Talc	300	430	All from Japan.
Other: Oxides and hydroxides of magnesium, strontium, barium	452	--	
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	700	1,258	Japan 1,150.
Coke and semicoke	20,706	27,870	All from Japan.
Petroleum:			
Crude oil and unspecified refinery products do.	4,000	4,100	All from U.S.S.R.[2]
Refinery products:			
Gasoline thousand 42-gallon barrels	467	751	Italy 735.
Kerosine do.	NA	44	All from Italy.
Distillate fuel oil do.	--	753	Singapore 624; Italy 129.
Residual fuel oil do.	2,651	1,492	All from Singapore.
Lubricants do.	383	313	Italy 290.
Other:			
Mineral jelly and wax do.	4	3	Japan 2.
Bitumen and other residues do.	5	58	Singapore 57.
Bituminous mixtures do.	87	--	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	3,715	4,712	All from Japan.

NA Not available.

[1] Owing to the lack of official trade data published by Vietnam, this table should not be taken as a complete presentation of Vietnam's mineral imports, with regard to either commodities or quantities. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

[2] Estimated on the bases of reported ruble value.

Early in 1979 the first offshore drilling since 1975 was started by Bow Valley and resulted in two dry holes. By the end of the year it was reported that Deminex had completed two holes, both dry, and was drilling a third, and AGIP had abandoned one hole and was drilling a second.

During 1978, the Vietnamese Government again claimed hydrocarbon discoveries while drilling onshore in the Red River delta. The first hydrocarbon shows were reported in 1975. Drilling is being done with Soviet assistance and equipment. Bottom-hole temperatures as high as 200°C complicate the drilling effort. No specific claim was made that the discoveries were commercial.[13]

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[1] By Gordon L. Kinney, physical scientist, Branch of Foreign Data.

[2] The Bangladesh fiscal year runs from July 1 through June 30. Where necessary, values have been converted from Bangladesh takas to U.S. dollars at the rate of US$1.00 = taka 15.0. All FY 1979 figures are provisional.

[3] U.S. Embassy, Dacca, Bangladesh. State Department Airgram A-77, Oct. 20, 1978, p. 2.

[4] Kuala Lumpur Business Times in English, Apr. 12, 1979, p. 6. FBIS-JPRS 093589, April 1979.

[5] Government of the People's Republic of Bangladesh, Dacca. Ministry of Planning. Bureau of Statistics, Statistics Division. 1979 Statistical Yearbook of Bangladesh. Apr. 12, 1979, pp. 242, 341, and 342.

[6] U.S. Embassy, Dacca, Bangladesh. State Department Airgram A-72, August 1978, p. 1.

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[7] U.S. Embassy, Dacca, Bangladesh. State Department Airgram A-77, Oct. 20, 1978, p. 2.

[8] U.S. Embassy, Dacca, Bangladesh. State Department Airgram A-71, Oct. 12, 1979, p. 3.

[9] By Gordon L. Kinney, physical scientist, Branch of Foreign Data.

[10] Where necessary, values have been converted from Brunei dollars (B$) to U.S. dollars at the rate of B$2.3354 = US$1.00.

[11] JPRS-072748 Kuala Belaid Borneo Bulletin in English, Dec. 16, 1978, p. 2.

[12] Prepared by Gordon L. Kinney, physical scientist, Branch of Foreign Data.

[13] By E. Chin, physical scientist, Branch of Foreign Data.

[14] Where necessary, values have been converted from Hong Kong dollars (HK$) to U.S. dollars at the rate of HK$4.98 = US$1.00.

[15] Far Eastern Economic Review Limited. Asia 1979 Yearbook. Hong Kong, 1979, pp. 179-192.

[16] By Gordon L. Kinney, physical scientist, Branch of Foreign Data.

[17] Far Eastern Economic Review. Asia 1980 Yearbook. P. 296.

[18] Summary of World Broadcasts, FE/W1007/A/13, Nov. 22, 1978, p. 13.

[19] Foreign Broadcast Information Service. May 18, 1978, from Phnom Penh domestic service in Kampuchean (Cambodian), 2300 hours GMT, May 10, 1978, p. H-3.

[20] Summary of World Broadcasts, FE/5931/C/1-13 Party Anniversary Speech by Pol Pot, Oct. 2, 1978, p. 7.

[21] Summary of World Broadcasts, FE/5931/C/1-13 Party Anniversary Speech by Pol Pot, Oct. 2, 1978, p. 7.

[22] Mining Journal. Mining Annual Review 1979. P. 446.

[23] Foreign Broadcast Information Service, June 29, 1979, (clandestine) SPK in French, 0413 hours GMT, June 29, 1979, BK.

[24] By Gordon L. Kinney, physical scientist, Branch of Foreign Data.

[25] Far Eastern Economic Review. Asia 1980 Yearbook. Hong Kong, p. 222.

[26] Business Review, Bangkok, Thailand, v. 7, No. 2, March 1979, p. 166.

[27] Business Review, Bangkok, Thailand, v. 7, No. 2, March 1979, p. 166.

[28] JPRS 73225 Translations of South and East Asia, No. 855, Apr. 13, 1979, p. 18.

[29] Mining Annual Review (London), 1979, p. 446.

[30] By E. Chin, physical scientist, Branch of Foreign Data.

[31] Far Eastern Economic Review Limited. Asia 1979 Yearbook, Hong Kong, 1979, pp. 252-255.

[32] By Gordon L. Kinney, physical scientist, Branch of Foreign Data.

[33] The Nepalese fiscal year runs from July 17 to July 16.

[34] Where necessary, values have been converted from Nepalese rupees (NRs) to U.S. dollars at the rate of NRs12.00 = US$1.00.

[35] Industrial Minerals, No. 138, March 1979, p. 86.

[36] By K. P. Wang, formerly supervisory physical scientist, Branch of Foreign Data.

[37] Where necessary, values have been converted from Singapore dollars (S$) to U.S. dollars at the rate of S$2.20 = US$1.00 for 1979, S$2.27 = US$1.00 for 1978, and S$2.43 = US$1.00 for 1977.

[38] Monthly Digest of Statistics (Singapore), June 1979, v. 18, No. 6, p. 17.

[39] Metals Week (New York), Feb. 12, 1979, p. 6.

[40] Rock Products (Chicago), April 1977, p. 94.

[41] By Gordon L. Kinney, physical scientist, Branch of Foreign Data.

[42] Because of fluctuating exchange rates, a meaningful conversion to U.S. currency is impractical. The average exchange rates for Sri Lanka rupees (Rs) were as follows for US$1.00: 1977 = Rs 9.15, 1978 = Rs 15.61, January to May 1979 = Rs 15.52.

[43] U.S. Embassy, Colombo, Sri Lanka. State Department Airgram A-46, June 7, 1979, p. 5.

[44] Far Eastern Economic Review (Hong Kong), v. 106, No. 51, Dec. 21, 1979, p. 36.

[45] U.S. Embassy, Colombo, Sri Lanka. State Department Airgram A-22, Apr. 5, 1979, p. 1.

[46] Mining Journal (London). Catalog, Survey, and Directory 1979. V. 32, No. 8, July 25, 1979, p. 239.

[47] Prepared by Gordon L. Kinney, physical scientist, Branch of Foreign Data.

[48] Far Eastern Economic Review. Asia 1980 Yearbook. P. 301.

[49] Far Eastern Economic Review. Asia 1980 Yearbook. P. 303.

[50] China Trade Report, v. XVI, June 1978, pp. 12-15.

[51] Hanoi Cong Nghiep Hoa Chat in Vietnamese, No. 3, June 1978, pp. 17-20.

[52] Hanoi VNA in English, 0228 GMT, July 13, 1978.

[53] The Oil and Gas Journal, v. 76, No. 31, July 31, 1978, p. 102.

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The Mineral Industry of Other Countries of the Near East

By Peter J. Clarke[1]

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BAHRAIN

The petroleum industry continued to be the most important mineral activity in Bahrain during 1978-79. Revenues generated by the petroleum sector increased from $378 million[2] in 1977 to an estimated $419 million in 1978 and approximately $522.5 million in 1979, despite decreasing production over the 2 year period. There were two oilfields that produced revenues for Bahrain; the Awali oilfield, the nation's only onshore producer, and the Abu Sa'fah oilfield, located in the Persian Gulf, north of Bahrain. The Awali oilfield has been decreasing output from a high of 27,973,000 barrels in 1970 to 19,000,000 barrels in 1979. Bahrain shared the revenues from the Abu Sa'fah oilfield with Saudi Arabia, as settlement of an ownership dispute. For the first time, in 1978, revenues from the Abu Sa'fah oilfield represented over 50% of the total receipts from the petroleum sector.

The years 1978-79 saw the gradual takeover of the Bahrain Petroleum Co. (Bapco), formerly a subsidiary of the California-Texas Petroleum Co. (Caltex), by the Government-owned Bahrain National Oil Co. (Banoco). By yearend 1978, Banoco owned 60% of Bapco, and Caltex the remaining 40%. The Government-owned company controlled exploration concessions, managed domestic marketing of petroleum products, and controlled natural gas production and marketing. On December 15, 1979, the Bahrain Government completed full takeover of the Bapco operations. Bapco will continue to own and operate the 250,000-barrel-per-day oil refinery located near Sitrah, as well as handle foreign marketing of petroleum products.

The Sitrah oil refinery processed all of Bahrain's crude oil output as well as over 70 million barrels of crude and blended stocks supplied from Saudi Arabia by underwater pipeline. For both 1978 and 1979, the refinery operated at or near its 250,000-barrel-per-day capacity, processing 247,000 barrels per day in 1978 and 251,250 barrels per day in 1979. The value of refinery exports were estimated at $1.2 billion in 1978 and $1.3 billion in 1979.[3] These export values were not to be confused with Government revenues, but were a combination of Bahrainian oil and reexported Saudi Arabian oil processed in Bahrain. The Government of Bahrain was following a formal policy to decrease domestic oil production by approximately 6% annually in an attempt to conserve the proven resources (estimated at 300 million barrels) until the end of the century.

The outlook for natural gas was more encouraging. Estimated reserves of 9 trillion cubic feet[4] of nonassociated gas were expected to last 70 years at 1979 production levels. The gas was derived from the Permian Khuff Formation, which underlies the oil-producing Triassic Bahrain Formation in the Awali oilfield. Production of natural gas rose from 131,150 million cubic feet in 1978 to 140,000 million cubic feet in 1979. During 1978, the gas was used to maintain pressure in the Awali oilfield, fuel the 300-megawatt powerplant at the Aluminum Bahrain Ltd.'s (Alba) smelter, fuel the Jupir powerplant-desalinization complex, and fuel the Sitrah refinery in its low-sulfur fuel oil complex and powerstation. The remainder (30%) was flared.

In March 1978, Banoco signed a $72 million contract with the Japan Gasoline Co. (JGC) to build a natural gas liquids (NGL) plant to utilize the flared natural gas. In April 1979, the Bahrain National Gas Co. (Banagas) was formed as a joint venture between Banoco (75%), Caltex (12.5%), and the Arab Petroleum Investments Corp. (Apicorp) (12.5%), to operate and manage the plant. On December 17, 1979, the plant was inaugurated 2 months ahead of schedule. The plant will utilize about 100 million cubic feet per day of associated gas for the production of 280,000 tons per year of NGL, 80,000 tons of propane, 75,000 tons of butane, and 125,000 tons of naphtha (natural gasoline), all of which was to be marketed by Caltex. Some of the residue gas was destined to become the base of a new petrochemical venture between Bahrain and Kuwait.

With supplies of oil running short within the next 20 years, the aluminum industry became the focal point of Bahrains attempt to diversify its economic base. For 4 consecutive years, the Alba smelter operated above its 120,000-ton-per-year design capacity. Export values of aluminum were $116.7 million in 1978 and $103.1 million in 1979.[5] The decrease in quantity and value of exported aluminum was due to a drastic reduction in Japanese aluminum imports in attempts to stabilize the yen on world markets.[6] All raw materials for the Alba smelter were imported except fuel. Australia was the sole supplier of alumina (235,000 tons per year),[7] coke and pitch were imported from the United States, and cryolite was imported from Japan. In 1979, plans were approved to expand the capacity of Alba by 45,000 tons per year, bringing the total capacity up to 165,000 tons per year. In addition, John Brown Engineers of Clydebank (United Kingdom) were awarded a $70 million contract for a new powerstation at the Alba plant. By 1980, Saudi Arabia was expected to acquire 20% ownership of the Alba plant, reducing the Bahrain Government's holdings to 57.9%, while leaving Kaiser Aluminum Bahrain's (United States) 17% and Breton Investments 5.1% shares unaffected.

The major imported minerals in Bahrain included cement from Japan (40,000 tons per year), stone and gravel from Dubai, and semimanufactured metals and nonmetals from Japan. The Government and the Saudi Cement Co. signed an agreement with Ishikawajima-Harima Heavy Industries Co. Ltd. of Japan to build a 6,000-ton-per-day cement plant near Ain Dar in the Eastern Province of Saudi Arabia. The plant was scheduled for completion in 1980 and was to supply approximately 500,000 tons per year of cement to Bahrain.

Plans were made in 1978-79 to further diversify Bahrain's economy. A joint venture was initiated between Bahrain and Kuwait to build a petrochemical plant to produce ammonia and methanol from Bahrain's abundant supplies of natural gas. The Bahrain-Kuwait Petrochemical Industries Co. was owned equally by the Kuwaiti Petrochemical Industries Co. (PIC) and Banoco. Production was to begin in late 1982. With completion of the modernization program of Mina Sulman Port, and the Arab Shipbuilding and Repair Yard (ASRY) scheduled for 1980, the reexporting industry in Bahrain was expected to grow. In addition, an $800 million multilane causeway, financed by Saudi Arabia, linking Jasra in Bahrain to Khobar in Saudi Arabia was planned to further increase Bahrain's flow of goods and also bring Bahrain closer into the Saudi defense sphere.

Table 1.—Other countries of the Near East: Production of mineral commodities

Country, commodity, and unit of measure	1976	1977	1978[p]	1979[e]
BAHRAIN[1]				
Aluminum metal, primary, smelter - - metric tons	122,058	121,356	122,800	126,000
Gas, natural:				
Gross - - million cubic feet	107,464	121,228	131,150	140,000
Marketed - - do.	76,931	83,392	91,805	98,000
Petroleum:				
Crude - - thousand 42-gallon barrels	21,287	21,236	20,190	19,000
Refinery products:				
Gasoline - - do.	9,520	9,829	11,099	11,250
Jet fuel - - do.	8,833	11,743	11,756	11,900
Kerosine - - do.	5,361	3,265	912	950
Distillate fuel oil - - do.	19,475	23,571	23,988	24,300
Residual fuel oil - - do.	26,476	33,687	29,373	29,800
Lubricants - - do.	--	344	379	400
Other - - do.	9,084	10,523	10,939	11,100
Refinery fuel and losses - - do.	1,257	2,271	1,507	1,550
Total - - do.	80,006	95,233	89,953	91,250
Sulfur, byproduct of petroleum - - thousand metric tons	10	7	26	25
JORDAN				
Cement, hydrauiic - - do.	533	566	564	624
Clays - - do.	12	6	9	10
Gypsum - - do.	21	22	36	36
Iron and steel: Crude steel - - do.	99	100	100	100
Lime - - do.	3	3	3	3
Petroleum refinery products:				
Gasoline - - thousand 42-gallon barrels	1,729	1,954	2,108	2,250
Jet fuel - - do.	834	872	1,152	1,250
Kerosine - - do.	1,241	829	1,146	1,250
Distillate fuel oil - - do.	2,505	2,604	3,109	3,300
Residual fuel oil - - do.	1,601	1,558	1,937	2,100
Other:				
Liquefied petroleum gas - - do.	428	394	500	550
Asphalt - - do.	385	497	643	700
Unspecified - - do.	4	--	49	50
Refinery fuel and losses - - do.	516	559	559	600
Total - - do.	9,243	9,267	11,203	12,050
Phosphate rock - - thousand metric tons	1,717	1,782	2,303	2,560
Salt - - do.	20	30	30	30
Stone:				
Limestone - - do.	5,000	5,000	6,000	6,000
Marble - - thousand square meters	150	([3])	160	200
LEBANON[1]				
Cement, hydraulic - - thousand metric tons	[e]1,704	1,360	1,381	1,360
Gypsum - - do.	[e]13	15	11	11
Iron and steel: Crude steel - - do.	8	7	6	--
Lime[e] - - do.	180	162	101	100
Petroleum refinery products:				
Gasoline - - thousand 42-gallon barrels	[e]3,904	2,809	4,019	5,300
Jet fuel - - do.	[e]1,097	964	1,019	1,350
Kerosine - - do.	[e]190	206	144	200
Distillate fuel oil - - do.	[e]3,101	2,432	2,354	3,100
Residual fuel oil - - do.	[e]4,650	4,595	4,367	5,750
Other:				
Liquefied petroleum gas - - do.	[e]775	531	--	--
Unspecified - - do.	--	--	151	200
Refinery fuel and losses - - do.	[e]906	1,011	724	960
Total - - do.	[e]14,623	12,548	12,778	16,860
Salt[e] - - thousand metric tons	35	35	12	12
OMAN				
Gas, natural:				
Gross - - million cubic feet	137,323	139,868	[e]140,000	145,000
Marketed - - do.	3,806	4,745	[e]5,500	20,000
Petroleum, crude - - thousand 42-gallon barrels	133,795	123,626	114,975	106,000
QATAR[1]				
Cement, hydraulic - - thousand metric tons	172	[e]170	208	[2]237
Iron and steel semimanufactures - - do.	--	--	86	350
Gas, natural:				
Gross - - million cubic feet	167,038	151,499	164,212	200,000
Marketed[4] - - do.	52,124	56,750	52,230	90,000
Nitrogen, N content of ammonia - - metric tons	[e]90,000	105,000	166,000	320,000

See footnotes at end of table.

Table 1.—Other countries of the Near East: Production of mineral commodities —Continued

Country, commodity, and unit of measure	1976	1977	1978[p]	1979[e]
QATAR[1] —Continued				
Petroleum:				
Crude thousand 42-gallon barrels	181,644	162,316	176,537	184,772
Refinery products:				
Gasoline do	671	764	796	850
Jet fuel do	382	449	455	500
Kerosine do	39	36	38	50
Distillate fuel oil do	840	927	908	1,000
Other do	46	61	72	75
Refinery fuel and losses do	30	362	1,439	1,500
Total do	2,008	2,599	3,708	3,975
Stone: Limestone thousand metric tons	[e]2,000	[e]2,500	3,103	3,000
SYRIA				
Asphalt, natural do	125	99	35	270
Cement, hydraulic do	1,110	1,395	1,433	1,180
Gas, natural:				
Gross[e] million cubic feet	61,000	69,400	56,500	60,000
Marketed do	7,800	[e]9,000	[e]7,500	7,500
Gypsum metric tons	62,496	85,643	[e]86,000	63,000
Iron and steel: Crude steel thousand metric tons	80	115	120	90
Nitrogen, N content of ammonia metric tons	[e]23,000	23,000	19,000	75,000
Petroleum:				
Crude thousand 42-gallon barrels	69,685	63,620	62,500	60,000
Refinery products:				
Gasoline do	3,434	4,599	4,675	6,000
Kerosine and jet fuel do	2,920	2,993	3,023	4,000
Distillate fuel oil do	5,282	8,067	8,355	10,000
Residual fuel oil do	7,273	9,125	8,924	12,000
Other:				
Liquefied petroleum gas do	244	365	464	800
Asphalt do	673	1,022	1,889	1,000
Refinery fuel and losses do	1,288	1,570	--	2,000
Total do	21,114	27,741	27,330	36,000
Phosphate rock thousand metric tons	511	425	[e]750	1,000
Salt do	54	106	[e]110	115
Stone, sand and gravel:				
Stone:				
Dimension: Marble cubic meters	NA	57,063	[e]50,000	50,000
Other thousand cubic meters	NA	985	[e]1,000	1,000
Sand and gravel do	NA	4,567	[e]5,000	5,000
Sulfur, byproduct of petroleum and natural gas thousand metric tons	5	[e]4	[e]6	6
PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN				
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	845	[e]1,440	850	1,000
Jet fuel do	1,169	[e]1,171	1,280	1,200
Kerosine do	779	[e]1,085	775	800
Distillate fuel oil do	2,808	[e]2,922	[e]2,000	[illegible]
Residual fuel oil do	6,019	[e]6,114	[e]6,000	6,000
Other do	765	[e]860	[e]700	900
Refinery fuel and losses do	772	[e]802	[e]869	870
Total do	13,157	[e]14,394	12,474	13,170
Salt[e] thousand metric tons	75	75	75	75
YEMEN ARAB REPUBLIC[1]				
Cement do	[e]60	60	63	[illegible]
Salt[e] do	100	75	30	[illegible]

[e]Estimate. [p]Preliminary. NA Not available.

[1] In addition to the commodities listed, a variety of other crude construction materials (common clays, stone, and sand and gravel) presumably is produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[2] Reported figure.

[3] Production reported as 150,000 cubic meters.

[4] Includes gas reinjected into reservoirs, if any.

JORDAN

The mineral industry in Jordan continued to be the base of economic expansion during 1978-79. Mining and the mineral industry contributed approximately 12% to Jordan's $1.8[8] billion gross domestic product (GDP) in 1978 and over 20% to the $2.2 billion 1979 GDP. Fertilizer raw materials, namely phosphates, were the leading exchange earners, grossing $70 million in 1978 and $90.5 million in 1979. Petroleum products were the second leading industry, with the refinery's net sales increasing from $65 million in 1978 to $70 million in 1979. Petroleum products were followed by cement, with a revenue increase from $40 million in 1978 to an estimated $45 million in 1979. Salt was the fourth leading mineral with revenues of approximately $300,000 for both years.

Despite the substantial (22%) growth in GDP from 1978 to 1979, Jordan continued to experience a growing trade deficit that amounted to $361 million in 1979. However, over 50% of Jordan's imports were for capital goods, which should help to reduce the imbalance. The deficit was more than made up for by receipts from tourism, official transfer payments from other Arab countries, and remittances from Jordanians working abroad, leaving a general balance of payments surplus of $17.3 million. The 1976-80 5-year plan aimed to reduce the trade deficit and keep an average GDP growth of around 12% per year, while increasing reliance on domestic revenues.

Phosphate production continued to be Jordan's major mineral industry. Output increased from 1.8 million tons in 1977 to 2.3 million tons in 1978 and 2.56 million tons in 1979. Phosphate exports reached a record 2.1 million tons in 1978 and an estimated 2.3 million tons in 1979. Earnings were down over previous years ($70 million in 1978) because of depressed world prices for phosphate rock. Prices slowly returned to their pre-1978 level, and 1979 earnings rebounded to nearly $90 million.[9] Phosphate mined in Jordan was exported to Western Europe (18%, mostly to Turkey and Italy), Eastern Europe (30% to Romania and Poland), Asia (50% mainly to India, Japan, and the Philippines), and Africa (2%).

There were two mines producing phosphate in Jordan, both operated by the Jordan Phosphate Mines Co., and another was scheduled to go into operation in 1980. The phosphate beds are usually found in two or three horizons that range between 35 and 65 meters in total thickness. Deposits occur fairly close to the surface in most places and consequently, open pit mining methods were used. The Ruseifa mine, located 15 kilometers north of Amman produced phosphate at about 800,000 tons per year for both 1978-79. The El Hasa mine, 200 kilometers north of Aqaba, extended its output from 1.5 million tons per year in 1978 to 1.7 million tons per year in 1979. In 1978, a $10 million walking dragline was purchased from Ransomes and Rapier (United Kingdom) for use at El Hasa. The equipment, which was to be commissioned in 1980, used a 35-cubic-meter bucket and could dig to a depth of 50 meters.

Plans were announced to open a mine at Wadi al Abuith, 20 kilometers north of El Hasa. Production was scheduled to begin in 1980 at about 1 million tons per year. Also, phosphate reserves at Shidayah, 130 kilometers north of Aqaba, were being considered for development, possibly for 1980. The general trend was to exploit the more southerly reserves, which are more abundant and closer to the port of Aqaba, and to decrease production in the north in a manner consistent with its smaller reserves. Jordan's total phosphate reserves were estimated at 2.5 billion tons.

Programs were underway in 1978-79 to expand the capacity of transportation, storage, and loading facilities for the phosphate industry. The third stage of the phosphate handling facilities at the port of Aqaba became operational in September 1979. The facility included a railway discharge station, a lorry discharge station, intermediate storage facilities, and shiploading facilities for an annual capacity of up to 5 million tons of phosphate.

One of Jordan's major industrial projects for 1978-79 was the construction of the $325 million fertilizer complex at Aqaba. The plant was due to start production in 1981, with an annual output of 650,000 tons of sulfuric acid, 365,000 tons of phosphoric acid, and 700,000 tons of monoammonium and diammonium phosphate. A contract to supervise design, construction, training, raw materials purchases, and operational tests for the fertilizer complex was awarded to Spie-Batignolles S.A. (France) and Badger Co. (United States). Shareholders in the Jordan Fertilizer Industries Co. (JFI) were the Jordanian Government (26%), Jordan Phosphate Mines Co. (25%), public shareholders in Jordan (17.4%), Arab Mining Co. (10%), Arab Petroleum Investments Corp. (10%), International Finance Corp. (5%), Islamic Development Bank (4.1%), and Caisse Jordanienne de Retroites (2.5%). Fertilizer purchase agreements were reached in May 1979 with Czechoslovakia in exchange for heavy machinery, sugar, cars, and textiles.

The Dead Sea potash project, the largest single industrial scheme in Jordan was under development in 1979 by the Arab Potash Co. (APC). Potash production was to start in late 1981 at about 1.2 million tons per year and increase to 1.5 million tons per year by 1989. Located on a 150-square-kilometer area in the southern basin of the Dead Sea, the plant was to process 1.2 million tons of crystalline carnallite, a potassium mineral, obtained from solar evaporation of Dead Sea brines. The Austrian firm, Voest Alpine, was awarded a $107 million contract by APC to construct the potash processing refinery. APC also awarded several other contracts: $122 million to George Wimpey and Co. (United Kingdom) for construction of dikes and evaporation ponds, $25 million to Jacobs Engineering (United States) for operation and supervision of the project and technical training of personnel; and R.A. Hanson Co. for design and construction of the carnallite harvesting machines.

APC was owned by the Jordan Government (51%), Arab Mining Co. (25%), Islamic Development Bank (7%), and by other Arab countries. Funds for the project were provided by shareholders, in addition to loans from the Libyan Arab Foreign Bank ($50 million), the Kuwait Fund for Arab Economic Development ($35 million), the International Bank for Reconstruction and Development ($35 million), the U.S. Agency for International Development ($33 million), and the Organization of Petroleum Exporting Countries (OPEC) Special Fund ($7 million).

Marketing of potash was contracted to Enterprise Miniere et Chimique (France) for Western Europe and Africa (280,000 tons per year), Mitsubishi (Japan) for Asia (600,000 tons per year), and Woodward and Dickerson (United States) for North and South America (400,000 tons per year).

Arrangements were made in 1978 to produce magnesium and bromine in association with the Dead Sea project. Ruthner Co. (Austria) was to construct a 50,000-ton-per-year refractory magnesia plant at an estimated cost of $60 million. Great Lakes Chemical Co. (United States) was to acquire a 25% share and provide technical assistance for the construction of a 30,000-ton-per-year bromine plant, also estimated to cost around $60 million.

Jordan's cement production was to increase from 634,000 tons per year to 2.6 million tons per year through the expansion of the Jordan Cement Co. plant at Fuheis and the construction of a new plant at Rashadiyah. Cement production during 1978 (564,000 tons) and 1979 (634,000 tons) was still below the 2.2-million-ton-per-year demand. Two production lines were to be added to the plant at Fuheis, to bring capacity of 3,000 tons per day by 1980. The Government concluded a contract with Kaiser Engineers (United States) for the construction of a $100 million cement plant at Rashadiyah in South Jordan. The plant was to produce 100 million tons per year of portland cement, mainly for export.

Two companies were producing steel in Jordan in 1978 and 1979. The Jordan Iron and Steel Industry Co., Ltd., produced steel bars and billets at its plant at Zarqa, while the Jordan Pipes Manufacturing Co., Ltd., produced galvanized pipes at its plant also located in Zarqa. Total iron and steel production in Jordan between the two companies was around 100,000 tons for both 1978 and 1979. The feed material for both plants was pig iron and ferroalloys imported from South Africa and the U.S.S.R., and scrap iron from Syria and Kuwait.

The Zarqa petroleum refinery produced 11.2 million barrels of petroleum products in 1978 and over 12 million barrels in 1979. Crude oil was imported from Saudi Arabia by way of the Trans-Arabian Pipeline (TAPline). The Romanian firm, Industrialexport, was supervising the expansion of the refinery's capacity to 60,000 barrels per day, almost double the 1979 operating volume, at a cost of about $190 million. New facilities at the refinery were to include a 43,000-barrel-per-day distillation unit, a 7,000-barrel-per-day gasoline reforming unit, and asphalt and isomax units.

In 1978, the consortium operated by Fil Exploration Corp., relinquished its petroleum exploration concessions which covered an 8,000-square-kilometer area on the east bank of the Jordan River. The Jordanian

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Natural Resources Authority contracted a nationwide aerial survey to locate possible petroleum reserves. Two U.S. firms, Phoenex Corp. and Geoterrex, were undertaking the survey, which was to be completed in 1 year.

The Jordan Government was also examining the possibility of developing its large reserves of oil shale. Bilateral negotiations with the U.S.S.R. were completed in September 1979 for the study of the economic advantages to developing the oil shale deposits.

Table 2.—Jordan: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum metal including alloys, unwrought and semimanufactures	475	450	Syria 383.
Copper matte	626	214	Egypt 151; Lebanon 41.
Iron and steel metal:			
Scrap	10,614	3,915	Lebanon 3,004.
Semimanufactures	6,116	1,204	Saudi Arabia 861.
Lead metal including alloys, all forms	358	768	Egypt 740.
Zinc metal including alloys, all forms	94	171	Saudi Arabia 81; Syria 67.
Other: Ash and residue containing nonferrous metals	103	1,310	Denmark 813; Lebanon 425.
NONMETALS			
Abrasives: Pumice, emery, natural corundum, etc	146	--	
Cement	2,856	240	Syria 239.
Chalk	348	740	Saudi Arabia 525; Lebanon 117.
Clays, crude	1,463	--	
Fertilizer materials, crude, phosphatic thousand tons	1,788	2,160	NA.
Lime	55	--	
Salt	392	NA	
Stone, sand and gravel:			
Dimension stone, crude and partly worked:			
Calcareous	86,902	97,914	Syria 69,972; Iraq 10,170; Kuwait 6,790; Saudi Arabia 5,556.
Other	26,058	53,904	Kuwait 42,319; Saudi Arabia 10,953.
Sand	2,403	5,041	Lebanon 2,375; Saudi Arabia 1,877.
Other: Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	38	39	Syria 26; Saudi Arabia 13.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen	27,283	12,723	Iraq 10,701; Lebanon 1,069; Abu Dhabi 952.
Coke and semicoke	32	31	All to Saudi Arabia.
Petroleum refinery products:			
Residual fuel oil thousand 42-gallon barrels	1	2	All to Syria.
Liquefied petroleum gas do	1	(1)	NA.
Other do	(1)	2	All to Syria.

NA Not available.
[1] Less than 1/2 unit.

Table 3.—Jordan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum:			
Oxides and hydroxides	25	--	
Metal including alloys, all forms	3,456	4,474	Greece 1,493; Lebanon 756; Taiwan 478.
Copper:			
Matte	55	67	Saudi Arabia 57.
Metal including alloys, all forms	402	520	Italy 271; Greece 81; Japan 53.
Iron and steel metal:			
Scrap	1,311	2,384	Kuwait 862; Lebanon 628.
Pig iron, ferroalloys, similar materials	1,021	5,601	Greece 4,990.
Steel, primary forms	53,341	56,728	West Germany 16,711; Australia 11,538; Mozambique 10,349.

Table 3.—Jordan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS —Continued			
Iron and steel metal —Continued			
Semimanufactures:			
Angles, shapes, sections	29,374	26,544	Belgium-Luxembourg 7,712; Japan 3,964; U.S.S.R. 3,311; Italy 2,991.
Universals, plates, sheets	33,246	33,270	Japan 13,812; Czechoslovakia 4,012; U.S.S.R. 1,719.
Wire	87,133	49,024	Lebanon 18,817; Republic of South Africa 5,780; Taiwan 3,342.
Hoop and strip	2,444	--	
Tubes, pipes, fittings	26,413	19,650	India 4,137; West Germany 2,625; Italy 2,481; Poland 1,707.
Total	178,610	128,488	
Lead:			
Oxides	209	348	United Kingdom 326.
Metal including alloys, all forms	1,742	3,786	Saudi Arabia 2,789; Kuwait 814.
Nickel metal including alloys, all forms	22	--	
Tin:			
Unwrought, waste, scrap	8	3	All from United Kingdom.
Metal including alloys	47	12	West Germany 6; United Kingdom 6.
Titanium oxides	1,143	691	West Germany 383; Italy 160; United Kingdom 72.
Zinc:			
Oxides	3	242	West Germany 140; China, mainland, 85.
Metal including alloys, all forms	247	394	Austria 380.
Other:			
Alkali, alkaline-earth, rare-earth metals	25	--	
Base metals including alloys, all forms	19	30	All from Turkey.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	1,558	152	Syria 87; Italy 54.
Grinding and polishing wheels and stones	162	273	Italy 75; Hong Kong 29; Japan 13.
Cement	418,012	622,532	Romania 196,986; Lebanon 190,699; Spain 90,612.
Chalk	2,907	3,788	United Kingdom 2,743.
Clays and clay products (including all refractory brick):			
Crude	541	816	United Kingdom 433; Greece 100.
Products:			
Refractory	2,949	2,588	West Germany 1,315; Italy 902.
Nonrefractory	8,755	5,616	Italy 3,169; Lebanon 841.
Feldspar and fluorspar	--	289	West Germany 100; France 99; Italy 80.
Fertilizer materials, crude and manufactured:			
Nitrogenous	13,205	18,437	Iraq 5,644; Lebanon 4,778; Kuwait 2,948; Austria 2,100.
Phosphatic	2,723	12,024	Lebanon 10,310.
Potassic	--	1,850	United Kingdom 1,750.
Other	773	670	Austria 400; Cyprus 155.
Gypsum	1,185	1,992	Syria 984; Lebanon 401.
Lime	1,288	1,466	All from Lebanon.
Pigments, mineral:			
Natural, crude	280	199	United Kingdom 110.
Iron oxides, processed	161	3,849	Lebanon 3,752.
Salt	1,657	1,410	Iraq 570; Kuwait 510.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	1,183	404	Italy 186; Kuwait 128.
Soda ash	779	302	Syria 212.
Caustic potash and sodic and potassic peroxides	82	--	
Stone, sand and gravel:			
Stone, worked:			
Calcareous	6,398	9,508	Italy 6,945; Lebanon 1,374.
Other	41	--	
Paving stone and flagstone	78	--	
Gravel and crushed rock	413	1,230	Italy 579; Lebanon 579.
Sulfur:			
Elemental, all forms	2,462	1,430	France 571; Kuwait 410; Iraq 365.
Colloidal	289	440	Lebanon 310; Kuwait 100.
Sulfuric acid	3,863	1,253	Greece 529; Iraq 342.
Other: Oxides and hydroxides of magnesium, strontium, barium	61	--	
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	59	155	United Kingdom 108.
Carbon black	--	1,004	West Germany 1,001.
Coke and semicoke	1,120	620	Lebanon 371; West Germany Germany [illegible]
Fuel briquets, all forms	394	--	
Hydrogen, helium, rare gases	52	341	Iraq 338.

Table 3.—Jordan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum:			
Crude ______ thousand 42-gallon barrels__	8,666	9,776	All from Saudi Arabia.
Refinery products:			
Gasoline ________________do____	4	3	Do.
Kerosine ________________do____	243	--	
Diesel oil ________________do____	329	--	
Lubricants ________________do____	172	105	Netherlands 19; Belgium-Luxembourg 18; United States 18.
Other ________________do____	157	2	Syria 1.
Total ________________do____	905	110	

LEBANON

The mineral sector was a minor contributor to Lebanon's economy during 1978-79. The principal mineral commodities and their approximate earnings for 1978-79 (respectively) were: refined petroleum products ($198 million[10] and $300 million), iron and steel semimanufactures ($100 million and $110 million), and cement ($70 million and $77 million). Lebanon also produced small amounts of gypsum, limestone, and salt.

Civil disturbances during 1978-79 created further problems for the nation's economy. Lebanon's trade deficit continued to worsen, from $1 billion in 1978, to $1.6 billion[11] in 1979, and the inflation rate remained above 30% for both years. Increased remittances from Lebanese workers abroad and reconstruction loans from other Arab countries helped to partially offset the balance of payments deficit. The Lebanese Board for Reconstruction and Development estimated that $7.2 billion was necessary to repair war damage in Lebanon. As of December 1979, Lebanon had received nearly $800 million in loans and grants over the past 5 years, mostly from Saudi Arabia, Kuwait, United Arab Emirates, and Qatar.

Lebanon's two refineries operated below capacity during 1978-79, owing mostly to civil disturbances. The Mediterranean Refining Co., (MEDRECO) refinery in Zahrani, just south of Sidon, operated at about 80% to 85% of its capacity of 17,000 barrels per day during 1978-79. MEDRECO was owned jointly by the Caltex (50%) and Mobil Oil Co. (50%). The Tripoli refinery operated at around 65% to 75% of its 35,000-barrel-per-day capacity during 1978-79. Operations at Tripoli were suspended for several weeks in late 1979 because storage tanks were full of refined petroleum products, and exports had been interrupted by closure of the Beirut-Tripoli road.

All of Lebanon's refinery feedstock for 1978-79 was imported from Saudi Arabia, by way of TAPline. In 1978, oil feedstock for the two refineries cost Lebanon $160 million. By 1979, the oil import bill had reached $287 million. Crude oil prices jumped from an average $13.00 per barrel in 1978 to around $18.50 per barrel in 1979.

On October 25, 1979, TAPline notified the Lebanon Ministry of Industry and Petroleum that it would discontinue supplies of Saudi crude from the ARAMCO oilfields to the Tripoli refinery as of January 1, 1980. The Saudi Government felt that Tripoli should draw feedstock from Iraq, its original source. The Iraq National Oil Co. (INOC) pipeline to the Banias terminal was reopened in February 1979, but no agreement was reached between Iraq and Lebanon for supplying the Tripoli refinery. On March 1, 1979, TAPline agreed to extend deliveries of crude to Tripoli only into the first quarter of 1980. TAPline was to supply 3 million barrels of oil to Tripoli before April 1, 1980.

Lebanon's cement production declined slightly from 1978 to 1979, but price increases generated greater revenues in the industry as a whole. Three cement plants were operating in Lebanon, all located in Chekka. All three plants were owned by private interests in Lebanon, and all three used limestone and gypsum quarried in Lebanon, just south of Tripoli for cement production. Production satisfied most of Lebanon's domestic requirements and also provided a substantial export market. Approximately 30% of cement production, valued at $25 million, was exported both years. In 1978, the Société des Ciments Libanais plant capacity was expanded from 1.2 million tons per year to 1.8 million tons per year by the addition of a 1,500-ton-per-day rotary kiln. The plant operated by Cimenterie Nationale S.A.L. was expanded from 500,000 tons per year to 1 million tons per year, and expansion was planned for the third plant, operated by Societe Libanais des Ciments, from 50,000 tons per year to 160,000 tons per year by 1980.

Production of iron and steel remained about the same throughout 1978-79. Approximately 20% of iron and steel produced in Lebanon was exported. Steel exports were valued at around $18 million per year. Consolidated Steel Lebanon S.A.L., located in Byblos-Amchit, north of Beirut, operated a bar, section, and rolling mill, with an annual capacity of 240,000 tons of rolled steel. The Lebanon Steel Mill Co. operated a steel furnace and bar mill with a capacity of 100,000 tons per year, and Societe Nationale des Tubes S.A.L. operated a tube and pipe mill in Dekwaneh, near Beirut.

Lebanon had reserves of low-grade iron ore in the north, and phosphate deposits in the south, which remained unexploited.

OMAN

Important developments in the minerals sector occurred during 1978-79 in Oman. New oil discoveries seemed likely to reverse the trend of declining production, while major steps were taken in the development of copper deposits, natural gas, the steel industry, and cement manufacturing.

Petroleum production continued to be the base of Oman's economy, constituting nearly 90% of Government revenues and 60% of the gross national product (GNP). Crude oil accounted for 95% of Oman's total exports, and contributed to the overall balance of payments surplus of $133.7 million[13] in 1978 and $328.2 million in 1979. The Government budget moved from a $100 million deficit in 1978, made up mostly by loans and grants from Saudi Arabia and the United Arab Emirates, to a $202 million budgetary surplus in 1979. Future revenues were to be derived from further petroleum development, utilization of natural gas reserves, development of northern copper deposits, a growing cement and steel industry, and possibly gypsum, limestone, and marble quarrying.

Since 1976, when oil production averaged 366,000 barrels per day, oil production in Oman has declined steadily. Production dropped from 340,000 barrels per day in 1977 to 314,000 barrels per day in 1978 and 295,000 barrels per day in 1979. Almost all Omani crude was exported, Japan (63.6%), United States (13.2%), Western Europe (18.4), Brazil (1.2%), and other (3.6%). Japan's share increased from 57% in 1978 to 64% in 1979, while the U.S. share declined slightly from 15% to 13%. Although not an OPEC country, Oman has generally followed the pricing policies of that organization. The official selling price of Omani crude throughout 1978 was a modest $13 per barrel. By December of 1979, that price had risen to $28 per barrel. Petroleum Development (Oman) Ltd., the only petroleum producer, was owned 60% by the Government, 34% by Shell, 4% by Compagnie Française des Petroles (CFP), and 2% by Participations and Explorations Corps. (Partex) (Portugal).

New discoveries of oil in 1978-79 showed promise for reversing the decline in production. While early oilfields were located in the northern Fahud area, exploration further south near Amal and Marmul turned up large quantities of medium- and heavy-grade crude. Soon after PDO announced plans in 1978 to ship the heavy crude out of a southern coastal terminal, other finds of higher quality 30° gravity oil were made nearby, allowing onfield blending. The mix was sufficiently light to be shipped north and join the Qarn Alam northern pipeline export system. The finds continued into 1979, when light crude was discovered in Jalmud, northeast of Marmul, and heavy crude in Runib, nearby. Again, mixing allowed more convenient transport north.

The southern reserves led to plans for a pipeline running from these Dhofar oilfields to Qarn Alam, where it would link to the main pipeline running to the Mina-al-Fahal terminal. Output of the pipeline, with all oilfields linked, was to total 100,000 barrels per day. Total project cost was estimated at $500 million.

In the Butabul region, near the Saudi Arabian border, the Essences et Lubrifiants de France (ELF) (48%), Sumitomo Metal Mining Co. Ltd. (SUMITOMO) (32%), and Wintershall A.G. (20%) consortium also struck oil. Flows of 12,000 barrels per day of

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45° gravity crude from Sahmah, and an estimated 20,000 to 30,000 barrels per day of 41° to 45° gravity crude from Ramlat were predicted. These were to flow through a 10-inch, 100-kilometer pipeline into the main Marmul-Qarn Alam line. Oil was to begin flowing in late 1980.

In October 1979, the Oman Government awarded a contract to Shell Internationale Petroleum Maatschappij N.V. of the Netherlands for the construction of Oman's projected 50,000-barrel-per-day oil refinery. Originally planned for a capacity of 25,000 barrels per day, the project was upgraded and expected to meet Oman's domestic requirements and provide a surplus for export. Oman previously imported petroleum products from Bahrain and the United Arab Emirates at the rate of 3.5 million barrels per year.

Natural gas also began a major role in Oman's economy during 1978-79. In November 1978, Oman's NGL project, located near Muscat, was inaugurated. The $87 million project was built by Snam Progetti, and will utilize gas carried from the Yibal gasfield by a 20-inch, 325-kilometer pipeline. Initial flow through the pipeline was 60 million cubic feet per day.

Yibal gas was also used to fuel the 225-megawatt powerplant-desalinization complex at al-Ghubra. Oman planned to extend the pipeline along the Batinah coast to Sohar, to be used in the $120 million copper smelting project of the Oman Mining Co. Also planned was a NGL fractionator to be located onfield at Yibal. The fractionator was to produce liquid petroleum gas (LPG) for domestic use. Lean residue gas was to be fed into the al-Ghubra pipeline, while condensate above propane was to be fed into the crude oilstream, effectively upgrading heavy crude from elsewhere. Reserves in the Yibal gasfield were estimated at over 5 trillion cubic feet.

Quintana Overseas International (60%) and Gulf (40%) reported a substantial gas find in the Shams gasfield in northern Oman. Reserves were estimated at 350 billion cubic feet. Output was expected to be about 50 million cubic feet per day, and tentative plans were made to pipe the gas to Dubai for use in the United Arab Emirates' aluminum smelter complex (Dubal).

Aside from gas and petroleum, the major mineral activity in Oman was the Sohar copper mining and smelter complex, located 200 kilometers northeast of Muscat. The project was a joint venture of the Oman Government (75%), Marshall Oman Exploration Co. (12.5%), and Prospection Ltd. of Canada (12.5%), which together formed the Oman Mining Co. Golder Moffit and Associates (United Kingdom) was contracted for mining operations; Kilborne Engineering (Canada) for ore concentration and smelting facilities; Moneco Overseas (United Kingdom) for power transmission and desalinization; and Cansult (Canada) for workers' housing.

Of nearly 60 copper occurrences, the largest were in the northern Oman mountains, 40 kilometers west of Sohar, at Laseil, Aarja, and Bayda. These occurrences contained, respectively, 8, 3, and 1 million tons of 2.1% copper ore, mostly in sulfides. The three deposits were to feed 3,000 tons per day of ore to the concentrating plant, which was to feed 270 tons per day of copper concentrate (25% to 28% Cu) to the smelter and refining plant. The project was to start production in 1982 with an annual output of 20,000 tons of 99.8% copper. Power for the mine was to be supplied by a new 30-megawatt turbine powerstation, fueled by gas from the Muscat pipeline. The mines expected lifetime was 15 to 20 years. The project was partly financed by a $100 million loan from Saudi Arabia. Total copper reserves in Oman were estimated at 20 million tons.

In 1978, the Government contracted Dastur Engineering (India) to conduct a feasibility study for a steel mill to be located in the Rusayl industrial zone. Initial stages were to involve only a rerolling mill, but production from local ores was also considered. Production was to be around 100,000 tons per year of steel reinforcing bars. The project cost was estimated at $40 million.

Cement was to be produced by the Oman Cement Co., owned jointly by the Oman Government (60%) and the Kuwait Cement Co. (40%), in a plant located in the Barka industrial zone. Plant capacity was to be 1 million tons per year. Production was scheduled to begin in 1980. Asbestos cement was being produced in small quantities by Amiantit-Oman, owned by Amiantit of Switzerland and Bahwan Co. The plant was located in the Rusayl industrial zone.

The Petroleum and Mineral Resources Ministry announced in December 1979 the discovery of a significant gypsum deposit in south Oman. The deposit was capable of supporting a 2,000-ton-per-year mining operation. Other recognized mineral deposits in Oman included asbestos (8 to 10 million tons); chromite (5 to 10 million tons); coal (10 million tons); and zinc, gold, iron, manganese, and phosphate. Asbestos and manganese were to be the subject of further studies. Oman's high-quality marble was already utilized at four plants and there were eight aggregate quarries. Significant deposits of limestone were also under study, possibly for use in the cement industry.

QATAR

The petroleum industry continued to be the base of Qatar's economy, accounting for 99% of total export earnings, over 90% of Government earnings, and approximately 55% of the GNP, estimated at $4.5 billion[13] in 1978 and $4.9 billion in 1979. The other mineral commodities and their values for 1978-79 (respectively) were nitrogenous fertilizers ($65 million and $128 million), iron and steel ($27 million and $131 million), limestone ($21 million both years), and cement ($13 million and $17 million).[14]

Qatar's economy settled somewhat during 1978-79 when the growth rate dropped to around 11%. This was in contrast to the rapid expansion that took place between the years 1974 and 1977 as a result of rising oil prices. Cutbacks in government spending were responsible for the moderation of the growth rate and also reducing inflation to near 9% in 1979, from a high of 50% in 1975. The balance of trade surplus increased from $1.2 billion in 1978, to an estimated $2 billion in 1979,[15] owing mostly to oil price increases and the rapid growth of Qatar's steel industry.

Qatar continued its emphasis on diversification of its light and heavy industry, using its reserves of oil and gas as feedstock and fuel. Over $1.8 billion was allocated for industrial projects and construction loans in the 1979-80 budget. Projects included expansion of cement and fertilizer production capacity, completion of a petrochemicals complex, and utilization of the huge reserves of natural gas in the production of NGL and liquified natural gas (LNG). The post oil economy will no doubt be dominated by these gas reserves, conservatively estimated at 100 trillion cubic feet. The Government was moving cautiously on development plans, hoping to use the gas only when oil supplies become scarce.

Qatar's crude petroleum production in 1979 increased 5% over 1978 levels. Production averaged 506,000 barrels per day in 1979, as opposed to 485,000 barrels per day in 1978. The percentage of this output produced from the onshore Dukhan oilfield declined 2.9% from 1978 to 1979, and comprised 45% of the total output for 1979. Oil from the Bul Hanine, Maydam Mahzam, and Idd el-Shargi offshore oilfields registered a 12% increase in output from 246,000 barrels per day in 1978 to 276,000 barrels per day in 1979. Qatar also shares the small Bunduq oilfield, located in the Persian Gulf between Qatar and the United Arab Emirates, with Abu Dhabi on a 50-50 basis. The oilfield produced about 6,000 barrels per day in 1978, but was shut down in 1979 due to pressure maintenance problems. Both Governments told the main concessionaire, United Petroleum Development (Japan), that a secondary recovery program must be instituted before production can be resumed.

Petroleum production in Qatar was regulated by the Qatar Petroleum Producing Authority (QPPA), and marketing was controlled by the Qatar General Petroleum Corp. (QGPC); both of which were government organizations. Companies operating onshore were British Petroleum (BP), CFP, Shell, Mobil, Exxon, and Partex (Portugal). The former offshore concessionaires were Shell and Ente Nazionale Idrocarburi (ENI). These companies purchased over 55% of Qatar's crude oil under 5-year agreements signed in 1976. In 1978, oil prices averaged $13.19 for 40° API Dukhan (onshore) and $13.00 for 36° API Marine (offshore). By yearend 1979, that price had reached $23.19 for Dukhan and $23.00 for Marine. Qatar exported 98% of its crude oil in 1978-79.

Qatar operated a small refinery in the Umm Said industrial zone, with a capacity of 4 million barrels per year of refined petroleum products. With the refinery operating near capacity in 1979, Qatar imported nearly 20% of its domestic fuel requirements. The Ministry of Industry and Agriculture planned to construct a 150,000-barrel-per-day export refinery in Umm Said, as part of the plan to diversify Qatar's industry. The cost of the project was estimated at $408 million.

The Government undertook several steps to utilize its substantial production of natural gas, which averaged 590 million cubic feet per day in 1978 and 548 million cubic feet per day in 1979. Associated gas from

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the onshore Dukhan gasfield was used for local power generation, and the remainder was transported by pipeline to the Umm Said industrial zone for use in Government owned power generation-water desalinization plants, the Qatar Fertilizer Co. (QAFCO), and the Qatar Petrochemical Co. (QAPCO). Offshore associated gas was flared in 1978. Qatar had previously used Dukhan associated gas in the production of LPG for export in 1976-77, but the plant at Umm Said was destroyed by fire. Two new NGL plants were under construction in 1978-79. NGL-1, due onstream in 1980, will process Dukhan gas in the production of 1,200 tons per day of natural gasoline, similar to the original NGL plant. NGL-2 will utilize associated gas from the offshore fields. All three fields completed offshore gas processing plants, and expected to make available 250 million cubic feet per day of associated gas for use in NGL-2. A 290-kilometer pipeline was under construction to transport gas from the offshore fields to Umm Said. From NGL-2's 360-million-cubic-feet-per day input capacity, it was to produce 1,100 tons per day of propane, 900 tons per day of butane, and 900 tons per day of natural gasoline. The plant was due onstream in 1982. As of December 1979, Mitsubishi Heavy Industries Co. and Idemitsu Co. (Japan) were the only firm customers, the former requesting 100,000 tons per year of natural gasoline, and the latter requesting 100,000 tons per year of natural gasoline and 200,000 tons per year of liquified petroleum gas.

Feasibility studies were undertaken in 1978, by the Qatar Gas Co., a joint venture of the QGPC (70%) and Shell (30%), for the development of the Northwest Dome (NWD) nonassociated gasfield. Discovered by Shell in 1972, the NWD was one of the largest gasfields in the world. Located in the Permian Khuff Formation, the source of much of the gas in the Middle East, this 2,000-square-kilometer offshore area was estimated to contain between 100 and 200 trillion cubic feet of natural gas. Qatar was reluctant to make any development plans, insisting that gas was severely underpriced on the world market. Since its discovery, only 5 producing wells had been drilled into the structure by December 1979. Possible long-term plans for NWD gas were the production of LNG and NGL, mainly for export as a replacement for dwindling oil supplies.

QAPCO began construction of its petrochemical complex in Umm Said. It was a joint venture of the Government (84%) and Charbonnages de France (CDF) Chimie (14%). The plant was to utilize tail gases from the production of NGL, and possibly NWD gas to produce 280,000 tons per year of ethylene, 140,000 tons per year of low-density polyethylene, and 46,000 tons per year of sulfur. A $200 million contract was awarded to Technip (France) for the ethylene unit; Coppee-Rust (Belgium) received an $800 million contract for the polyethylene unit; Turbotechnica, a subsidiary of ENI (Italy) received a $30 million contract for construction of a 50 megawatt powerplant; and JGC was awarded a $79 million contract for ancillary facilities, including seawater intakes, a feed gas supply system, pipelines, and storage tanks. The entire system was expected to begin production in 1982.

QAFCO produced 201,000 tons of ammonia and 256,000 tons of urea in 1978. Through the addition of a second fertilizer plant, output was increased to 222,000 tons of ammonia and 337,000 tons of urea in 1979, all of which was exported. QAFCO was located in Umm Said, and was owned by the Government (70%), Norsk Hydro A.S. (Norway) (25%), Davy Powergas Corp. Ltd. (3%), and Hambros Bank Ltd. (United Kingdom) (3%). Norsk Hydro was managing contractor and also marketed products on behalf of the company. The total design capacity of both plants was 675,000 tons per year of ammonia and 730,000 tons per year of urea.

The Qatar Steel Co. (QASCO) began production in 1978, when output totaled over 85,000 tons. In 1979, that output had almost quadrupled to over 350,000 tons. The steelworks located near the capital, Doha, included a direct reduction plant, two arc furnaces, two four-strand, continuous-billet casters, and a rolling mill. The total design capacity was 400,000 tons per year of raw steel and 330,000 tons per year of rolled steel. Feedstock for the plant was 600,000 tons per year of pellets from Sweden and Brazil and scrap from the United States. Nearly 75% of the mill's output was exported to Iraq, Saudi Arabia, Kuwait, and the United Arab Emirates. The planned expansion of capacity by 200,000 tons per year was delayed, pending the formation of the Persian Gulf Steel Development Association, to oversee the steel production boom in the Middle East. QASCO was owned 70% by the Government, 20% by Kobe Steel, and 10% by Tokyo Boeki (Japan).

Cement production from the Qatar National Cement Co., the nations only cement plant, was around 210,000 tons of portland cement in 1978 and 237,000 tons in 1979; about 55% of the domestic requirement. The plant's annual production capacity was to be expanded from 300,000 to 580,000 tons, which was expected to meet Qatar's requirements into the 1980's. A lime calcination unit was being installed at the cement plant by Newell Dunford Engineering Ltd. (United Kingdom).

SYRIA

Syria's mineral sector contributed an average 15% to the 1978-79 GDP, estimated at $6.8 billion[14] and $7.4 billion (respectively). The major mineral commodities were petroleum and phosphate rock, which together comprised over 65% of total exports. Rapid growth following the 1973 war brought on high inflation and a widening trade deficit. Strong measures to alleviate these problems in 1977-78 succeeded in their aim, but only at the cost of a drastic reduction in GDP for 1978. Several projects in the 1976-80 5-year plan had to be cancelled. Over $1.8 billion in Arab economic aid and increased revenues from oil turned the country around in 1979. Reopening of the Iraq-Syria oil pipeline, closed in 1976 after a dispute over petroleum transit fees, helped industry get back above pre-1978 levels. Balance of payments performance also turned around to a net increase in reserves, more than offsetting the $100 million deficit in 1978. Syria encouraged foreign investment in the mineral industry, mainly on a production-sharing basis, and since 1977, four foreign oil companies have joined the renewed exploration efforts, three of them from the United States.

Syria's petroleum production in 1979 averaged 190,000 barrels per day, a slight increase over the 1978 level of 171,000 barrels per day, which was the lowest output in 4 years. Oil exports for both years remained around 132,000 barrels per day, 90% of which was destined for Western Europe. Five oilfields were being exploited (Rumeilan, Karachuk, Suweidiyah, Jebisseh, and Olayan) all near the Syria-Turkey-Iran triangle. All but the Jebisseh oilfield produced low-gravity (21° to 25° API), high-sulfur (4.5% to 9.5%) crude. Jebisseh had an estimated reserve of 350 million barrels of 40.5 API low-sulfur crude. Syria's total oil reserves were estimated at 1.6 billion barrels.

Oil production in Syria was controlled by the State-owned Syrian Petroleum Co., under the direction of the General Establishment for Geology and Mineral Resources. Government policy allowed cooperation with foreign firms, and several companies were awarded production-sharing agreements from 1977 to 1979. The Government retained a minimum share of 51% in all ventures. Of the 15 oil-producing rigs in Syria, 12 were State-owned, and one each was owned by Pecten Syria Co., the Syrian American Oil Co. (SAMOCO), and Rompetrol of Romania. Pecten operated a 21,800-square-kilometer production sharing concession north of Palmyra, which it acquired in early 1978. SAMOCO acquired a 15,750-square-kilometer concession, also on a production-sharing basis, in the Dair-al-Zor area in 1977, and had since spudded only one well. Rompetrol also operated a concession in northeast Syria, but no details were available on drilling operations. Challenger Desert Oil Co. of Panama (Chadoil) finalized a production-sharing arrangement in 1978, for a 17,000-square-kilometer concession south of Palmyra. Chadoil was to spend 4 years and not less than $3.5 million on exploration. Should a commercial discovery be made, the output split, after cost recovery, was to be 75%/25% in Syria's favor. Marathon Oil Co. of the United States also signed a production-sharing agreement in March 1979 for a 15,000-square-kilometer concession 200 kilometers northeast of Damascus, but the agreement had yet to be ratified by the Syrian Government.

Syria continued its oil exploration efforts, in search of additional reserves. The Government commissioned its first national seismologic team in 1978 to study several areas in the northeast region. Digital Resources Inc. (United States) was awarded a $1.5 million contract for a seismic data processing system.

The Homs refinery operated at 94% of its 38-million-barrel-per-year capacity during 1979. This was a substantial increase over the 72% utilization factor in 1978. Late in 1978, the Supreme Planning Council approved an allocation of $76 million for modernization and expansion of the refin-

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ery. In December 1979, a new 120,000-ton-per-year asphalt plant was added. The plant, built by Technoexport of Czechoslovakia, which had constructed most of the units of the refinery, raised the plants output of asphalt to 250,000 tons per year. Bids were also invited for the planned construction of a 450,000-ton-per-year naphtha hydrotreater, a 370,000-ton-per-year kerosine and gas-oil unit, and a 380,000-ton-per-year premium gasoline unit.

Syria's second refinery, located in Banias, was inaugurated in August 1979. It was designed to process a blend of either 80% Iraqi-20% Syrian crude, or 50% Iraqi-50% Syrian crude. The refinery was constructed by Industrialexport of Romania. When the plant goes onstream in 1980, Syria's refinery capacity will exceed its crude oil output.

In 1979, the INOC pipeline from Iraq to Banias was reopened. The settlement with Iraq was to make available 37 million barrels per year of Iraqi crude to Syria at posted Persian Gulf prices. The agreement was to provide $120 million in revenues and import savings for Syria on an annual basis. The Homs refinery was to continue using Saudi Arabian crude for feedstock, while the new refinery at Banias was to use Iraqi crude from the pipeline.

Syria also planned to make full use of its gas resources. The Syrian Oil Ministry was considering commissioning a detailed study of the country's gas reserves. A $60 million contract was awarded to the French firm, Entrepose, to construct a gas-gathering and liquefaction plant. The contract also provided for the installation of a 60-kilometer pipeline network, construction of dehydration, desulfurization, gas-oil separation units, and a plant for the manufacture of industrial solvents and condensates. The plant, to be located in northeast Syria, was to process 58,000 tons per year of LPG by 1982. Syria's total gas reserves, both associated and nonassociated were estimated at 130 billion cubic meters.

Syria's phosphate industry registered a significant upturn in production in 1978-79, in response to improved prices. Production had fallen back to 425,000 tons in 1977, the lowest level in 5 years, but rose 40% in 1978 and another 25% in 1979. Exports in 1978 amounted to 895,000 tons, a 29% increase over 1977, and 1979 exports were estimated at nearly 1.2 million tons. Phosphate exports earned Syria over $23 million annually, with over 50% of production going to Romania, 20% to North Korea, 10% to Lebanon, and 7% to both The People's Republic of China and Bulgaria.

Phosphate production was concentrated in three areas, all located at Palmyra in central Syria. Al-Tadmuria, Mukaman Al Shargiya, and Mukaman Khunayfis had a combined production capacity of 1.2 million tons per year. These mines were under the direction of the General Co. for Phosphates and Mines (GECOPHAM), and were opened with financial and technical assistance from Poland, Romania, and Bulgaria. Crude mined phosphate from these areas had an average P_2O_5 content of 26% and was generally high in chlorine. Syria's total phosphate reserves were estimated at 600 million tons.

Phosphate mined in northeast Syria was trucked to the port of Tartous for export. The ports current handling capacity of 50,000 tons and loading capacity of 1,000 tons per hour was undergoing expansion in 1979 to bring storage capacity to 140,000 tons. Under the current 5-year plan, $38 million was to be spent to bring phosphate production to 3 million tons per year by 1981. Negotiations were underway with ENI (Italy) concerning a joint venture for exploration and development of new phosphate reserves. Hydrologic studies were also underway to determine the availability of water for use in new washing plants to improve recovery of phosphate rock. The washing facilities were ordered from Romania in 1979.

Syria's single fertilizer complex, at Homs, produced around 77,000 tons of nitrogenous fertilizer per year, well below its 110,000-ton-per-year capacity. Creusot-Loire (France) completed work on a 1,000-ton-per-day ammonia-urea complex at Homs, and was in the process of turning the plant over to the Syrians. Also near completion, in Homs, was a 450,000-ton-per-year triple superphosphate plant, scheduled to go onstream in late 1980. The plant was built by Industrialexport of Romania.

A railroad system to connect the mining district to the fertilizer complexes in Homs was under construction in 1979. Homs was already linked to the port of Tartous from which fertilizer production will be exported.

Iron and steel production in Syria remained fairly constant during 1978-79, averaging 100,000 tons per year. The General Co. of Iron and Steel Products operated three plants at its complex in Hama. A 110,000-ton-per-year cold rolling mill manufactured steel bars from billets imported from Italy, Bulgaria, and the U.S.S.R. A 20,000-ton-per-year merchant mill produced galvanized and ungalvanized pipe and a 120,000-ton-per-year sponge iron smelter produced billets from sponge and scrap iron. A feasibility study was being conducted by an Indian consulting company to evaluate the iron ore deposits in the Zabadani region, 50 kilometers west of Damascus near the Lebanese border. The reserves were estimated at 150 million tons of hematite with an iron oxide content of 27% to 30%. Iron ore deposits were also located north of Aleppo, but contained a high level of impurities, mainly silicon.

Cement production in Syria continued its gradual expansion, increasing an average of 15% per year, under the direction of the General Organization for Cement. The Chaba Cement Co. raised its production capacity to 1 million tons per year; it operated three plants near Aleppo at Sheikh Said, Muslimiyah, and Burg Islam. The Syrian Cement Co. operated a 460,000-ton-per-year plant at Hama, and a 110,000-ton-per-year plant at Homs. The National Co. for Cement operated a 280,000-ton-per-year plant at Dummar. Two new plants were scheduled to begin production in 1980; a 150,000-ton-per-year plant at Adra, and a 200,000-ton-per-year plant at Tartous.

In 1978, the general establishment for Geology and Mineral Resources contracted Industria Marmi e Graniti (Italy) to quarry marble at Damascus and Latakia. Marble production averaged 50,000 cubic meters both years and was used mainly for export. Quarrying of asphalt near Deir ez Zoor and Latakia began in 1976, and production increased dramatically in 1979. Syria has also mined salt since 1971, and nearly 120,000 tons were produced in 1979.

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN

The mineral industry of the People's Democratic Republic of Yemen (PDRY) consisted of the refining of imported crude oil and the mining of salt. Refined petroleum products accounted for over 80% of total export value in 1978-79, estimated at $212 million[17] and $300 million, respectively. Other income was derived from the export of salt to African countries. PDRY's major imports were food ($225 million), cement and construction materials ($18 million), oil byproducts ($87 million), and industrial raw materials ($41 million). A combined low productivity in the industrial sector, and South Yemen's very limited natural resources contributed to a balance of trade deficit of over $200 million in 1979. The second 5-year plan (1979-83), which allocated 5% of total expenditure to petroleum and mineral exploration, was to be financed largely by foreign loans and grants. Financial commitments of $110 million from the U.S.S.R., $38 million from Bulgaria and Czechoslovakia, and $13 million from the Peoples Republic of China were received in 1978-79.

Port facilities at Aden, one of the worlds largest oil-bunkering ports prior to the closure of the Suez Canal in 1967, was being renovated and modernized through the assistance of a $14 million loan from the Arab Fund for Economic and Social Development (AFESD) and a supplementary loan from the International Bank for Reconstruction and Development (IBRD). Electric generating capacity, estimated at 100 megawatts, was to be doubled by the construction of two new powerstations in Aden and Mukalla, both to be financed by the U.S.S.R.

Within the Petroleum and Minerals Organization, the Geology and Mineral Exploration Department was responsible for the coordination and conduct of geologic and seismic surveys, and the Petroleum Exploration Department was responsible for all oil exploration activities. Under the second 5-year plan, the Government was to continue its investigation of potential iron and titanium resources in the Wadi Mikayris region, and copper occurrences in the Maahir-Ghabar area, 150 kilometers southwest of Mukalla.

The Petroleum and Minerals Board (PMB) opened five onshore areas to international bidding for petroleum exploration in 1979. The areas, all located in the north, were offered under production-sharing arrangements, with a minimum requirement that two wells be drilled within a 3 year period. In the event of a commercial discovery, the company was to recover their costs out of 40% of crude production. Sixty percent of the equity would go to PMB, for a further production split with the operator. Siebens Oil and Gas Ltd. (Canada) drilled and abandoned a wildcat in its 17,5 square-kilometer-concession on Socotra Island and offshore areas. Azienda Generale Italiani Petroli S.p.A. (AGIP) spudded a wildcat in its 10,000-square-kilometer of-shore area near Sayut. In 1979, AGIP obtained a new 15,000-square-kilometer concession off the Mukalla coast. The Russian firm Technoexport also operated a 10,000-square-kilometer tract off the Thamud coast.

Late in 1979, the World Bank's International Development Association (IDA) approved a $9 million credit for a major petroleum exploration project. The project was to include a 15-month seismic survey over a large portion of the onshore area, as well as project management, technical assistance, data evaluation, and promotion of exploration areas to foreign oil companies. The survey was to be conducted by a team of expatriates, who were to assist in training a local Yemeni staff. PDRY contributed $1 million to the cost of the project, which was to be completed by 1982.

The petroleum refinery at Aden, owned by BP until nationalized in 1977, operated at less than 25% of its 160,000-barrel-per-day capacity for its fifth consecutive year. Production averaged 35,000 barrels per day in both 1978-79. The refinery imported crude oil from Kuwait, Qatar, and the United Arab Emirates. Saudi Arabia ceased exporting crude to PDRY in 1978 owing to political differences. The Government acquired ownership of all oil-bunkering facilities in Aden in 1978, under an agreement with BP. The Yemen National Petroleum Co. was created to assume responsibility for transporting, storing, marketing, and distributing petroleum products in the wake of BP's departure.

Salt production continued at a modest pace, averaging 75,000 tons per year in 1978-79. Salt was produced at the General Salt Organization's facilities at Khawr Maksoir northeast of Aden. The plant produced unrefined marine salt from the evaporation of seawater. Nearly 90% of production was exported to African countries.

YEMEN ARAB REPUBLIC

The mineral industry of the Yemen Arab Republic was of little significance to the country's economy. Mineral activity consisted of the mining of salt and gypsum, and the production of cement. Salt remained the only mineral export, with revenues of approximately $110,000[18] in 1978 and $280,000 in 1979. Exploration for petroleum resources and copper continued, but no production was registered for either commodity.

The Yemen Arab Republic's only significant export was manpower, with remittances from Yemenis working abroad, mostly in Saudi Arabia, amounting to $1.4 billion in both 1978 and 1979. Until 1977 or 1978, these remittances brought growing balance of payments surpluses and increasing foreign exchange reserves, despite a large balance of trade deficit, averaging $800 million for the 2 years. By 1979 the situation had changed. Remittances remained fairly constant, but because of a dormant industrial sector, the import bill began outpacing revenues, and the overall balance of payments surplus dropped from $340 million in 1978 to $160 million in 1979, and a deficit was expected for 1980.[18]

Under the 5-year plan (1976-80), Yemen's growth was continuous but uneven. GNP rose by 8% from 1978 to 1979, but 30% to 35% inflation remained a problem. Yemen's second 5-year plan was expected to concentrate on infrastructure development, expansion of the commercial-industrial sector, and increased agricultural output.

The Yemen Salt Mining Corp. continued its open pit mining of rock salt at Salif. Modernization of the mine and shiploading facilities in 1977 upgraded capacity from 100,000 tons per year to 1 million tons per year. The Salif deposit was located on the mainland side of the Kamaran passage which forms the sheltered deepwater harbor of Salif. The deposit was estimated at 250 million tons of rock salt with a 98.2% NaCl and 0.36% Ca content. The major stumbling block of the operation was no longer mining and loading, but marketing. During the 5-year modernization project, 1972-77, the company's major buyer, Japan, had found other sources of salt, and was unwilling to renew any contracts in 1978 or 1979. The company was forced to sell on the spot market and through short-term contracts. The United Nations stepped in to help in late 1977, and appointed Roskill Industrial Consultants (United Kingdom) to conduct a worldwide marketing survey for the Yemen Salt Mining Corp. North Korea and Bangladesh both agreed to import salt in 1978, and the industry was looking toward the opening of new chloralkali plants in the Middle East for an export market.

Gypsum was recovered in association with rock salt in Salif, and was sold to the

Government-run cement plant at Bajil. In 1978, the U.S.S.R. agreed to extend $38 million in credits to triple the plant's 100,000-ton-per-year capacity. In 1979, the Yemen Government awarded a $110 million contract to Ishikawajima-Harima Heavy Industries and Nissho-Iwai (Japan) for the construction of a 500,000-ton-per-year cement plant at Amran, northeast of Sana. The contract also covered installation of a powerplant and a workers' housing scheme. The project was scheduled for completion in 1982.

Oil exploration efforts continued in 1978-79, with Shell holding the only exploration rights in a 10,000-square-kilometer tract in the Tihama coastal plain. Shell drilled two test wells off the coast, and reported a noncommercial discovery of natural gas. Petro-Stock International of Texas was to begin exploration efforts in eastern Yemen late in 1979.

Efforts were also underway in 1979 to improve the supply and distribution of petroleum products. The Yemen Arab Republic imported all of its petroleum requirements, mainly from Kuwait and Saudi Arabia. Mobil Oil Corp. and the Yemen Oil and Minerals Corp. (YOMINCO) reached an agreement in mid-1979 for Mobil to construct and operate a plant producing lubricating and other oils. YOMINCO was also negotiating with Mobil for the construction of a pipeline for petroleum products to run from the port of Salif to Sana and the interior of the country.

Studies continued in the possibility of exploiting copper deposits near Taiz and Beida. Chemical analysis showed the Taiz deposit to be 15% to 19% Cu, with 2% Ni and 1.5% Co, but as of yearend 1979, there were no plans for production.

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[1] Physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Bahraini Dinars (BD) to U.S. dollars at the rate of BD0.476 = US$1.00.

[3] International Monetary Fund, International Financial Statistics. V. 22, No. 4, April 1980, pp. 72-73.

[4] Abecor Banks, London. Abecor Country Report, Abecor Banks, Bahrain 1980. W. Lea, Printer.

[5] International Monetary Fund. International Financial Statistics. V. 33, No. 4, April 1980, pp. 72-73.

[6] Financial Times, London. Bahrain June 5, 1980, p. III-1.

[7] Metal Bulletin Limited, London. Industrial Minerals No. 148, January 1980, p. 70.

[8] Where necessary, values have been converted from Jordan Dinars (JD) to U.S. dollars at the rate of JD300 = US$1.00.

[9] International Monetary Fund. International Financial Statistics. V. 33, No. 6, June 1980, pp. 224-225.

[10] Where necessary, values have been converted from Lebanese pounds (LL) to U.S. dollars at the rate of LL3.00 = US$1.00.

[11] International Monetary Fund. International Financial Statistics. V. 33, No. 7, July 1980, pp. 238-239.

[12] Where necessary, values have been converted from Omani rials (RO) to U.S. dollars at the rate of RO0.345 = US$1.00.

[13] Where necessary, values have been converted from Qatari Riayls (QR) to U.S. dollars at the rate of QR3.70 = US$1.00.

[14] U.S. Embassy, Doha, Qatar. Department of State Telegram, 1978 and 1979 Minerals Questionnaires; May 6, 1979; U.S. Embassy, Doha, Qatar. Department of State Telegram, Apr. 13, 1979.

[15] International Monetary Fund. International Financial Statistics. V. 33, No. 7, July 1980, pp. 324-325.

[16] Where necessary, values have been converted from Syrian pounds (LS) to U.S. dollars at the rate of LS3.95 = US$1.00.

[17] Where necessary, values have been converted from Yemeni Dinars (SYD) to U.S. dollars at the rate of SYD0.345 = US$1.00.

[18] Where necessary, values have been converted from Yemeni Riyals (YRls) to U.S. dollars at the rate of YRls4.50 = US$1.00.

[19] U.S. Department of Commerce, Washington, D.C. Foreign Economic Trends and Their Implications for the United States. FET 80-038, May 1980, p. 3.

The Mineral Industry of Other Areas of South America

By Doris M. Hyde[1]

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ECUADOR

The petroleum sector continued to dominate Ecuador's economic activity in 1978, accounting for nearly 10% of the gross domestic product (GDP) and 42% of total export earnings. In 1978, a more flexible petroleum export price was adopted which permitted an expansion of foreign market opportunities. During 1979, Ecuador took advantage of disruptions in the world petroleum supply and renegotiated existing export contracts to accomodate the rapidly escalating world market price. Petroleum sales on the spot market were maximized, and prices reached unprecedented levels. By taking royalty payments in-kind, Ecuador increased its volume of petroleum available for term and spot sales. Although the volume remained about the same as in 1978, the total value of 1979 petroleum exports increased to about $920 million, reflecting a 76% increase over the $523 million received for 1978 crude oil exports.

Concerned about its steadily decreasing petroleum reserves (recently estimated at about 1.1 billion barrels), rapidly increasing and heavily subsidized domestic consumption, and the prospect of having to import substantial amounts of petroleum by 1983, Ecuador announced plans which it anticipates will double reserves within the next 5 years. The Government plans to spend $1 billion over the 5-year period. Plans include drilling 325 exploration and development wells and establishment of a secondary recovery program for the Sachs and Shushufindi fields. Some exploration wells are expected to reach a depth of 17,000 feet. It is thought that substantial reserves exist in the southeast Amazon region. Late in 1979, it was announced that some 10 million hectares will be available for exploration tenders—probably in blocks of about 200,000 hectares each—in the Amazon jungle of the Oriente and in the coastal and offshore regions. The Government planned to commission a private, independent analysis of Ecuador's petroleum reserves that would also include recommendations on efficient production levels.

Modifications to Ecuador's Hydrocarbon Law were made in 1978. These modifications allow the implementation of a new type of petroleum operations contract designed to attract foreign investors for exploratory activities. Under this type of contract, a foreign firm assumes exploratory risks in return for a share in any future production. If exploitable reserves are discovered, a percentage of oil production is assigned to the firm to repay all its costs, including amounts attributable to operations, transportation, and amortization, plus a fee to promote scientific and technological development in the energy field. The remainder of production is divided between the firm and CEPE according to the rate of return on investment agreed upon by the two entities. Discoveries of large volumes of reserves could yield returns on investment of up to 35% to foreign firms, while smaller discoveries would result in returns of at least 18%. Under the new contract arrangements, net profits would equal gross profits minus a percentage for labor profit sharing minus any taxes on the difference between gross profits and the profit-sharing percentage. Implementing regulations and a model contract are expected to be issued early in 1980.

Texaco, Inc. and Corporación Estatal Petrolera Ecuatoriana (CEPE) moved closer to forming a new company, Petroamazonas, intended to replace their present consortium. The new company was expected to become operational early in 1980.

In June 1978, City Ecuatoriana Production Co. (CEPCO), a subsidiary of the U.S. firm City Investing Co., and CEPE began transporting crude oil through the Trans-Andean pipeline from three fields in Oriente Province. Unable to reconcile differences with Northwest Pipeline Corp. for natural gas production from the Gulf of Guayaquil, the Government cancelled its contract with that company. Despite a controversy over economic feasibility, CEPE was expected to assume control of the Amistad gas field and proceed with contracting for construction of a petrochemical complex.

In April 1979, Gulf Oil Corp. received final payment for its assets sold to the Government in 1976; the total payment was $115.7 million. In December 1978, Gulf closed its 8,000-barrel-per-day refinery on the Santa Elena Peninsula. The refinery was reportedly sold and reopened that same month.

CEPE plans to increase Ecuador's total refining capacity to 185,000 barrels per day from the present level of 98,500 barrels per day. At a cost of about $200 million, plans are to increase capacity at the Esmeraldas refinery from the present level of 55,600 barrels per day to 130,600 barrels per day. Another $13 million investment is planned for a new 10,000-barrel-per-day facility to be built at the Sacha field in the eastern jungle.

Construction of the second stage of an offshore tanker terminal for exporting petroleum products from Esmeraldas was contracted in 1979. Plans are for this permanent facility to provide a two-berth sea-island terminal capable of servicing vessels up to 50,000 deadweight tons. A variety of products ranging from heavy fuel oil to liquid petroleum gas is expected to be loaded from the terminal.

Ecuador's nonfuel minerals industry remained of minor importance and no new mining operations were initiated during 1978 or 1979. Empresa Nacional Adaro of Spain has invested about $1.5 million over the past 2 years exploring for copper in a 36,000-square-kilometer area near Chaucha in the western mountains. The Ecuadorean atomic energy commission has been given the responsibility of exploring for and developing radioactive minerals. In 1978, it was reported that uranium deposits had been discovered in the eastern Andes.

In 1979, a geological survey sponsored by the United Nations Development Program reportedly found iron ore deposits in the province of El Oro, but the discovery awaits definitive geophysical and geochemical testing. In 1979, the local firm Cumbaratza contracted with the Government to explore for and develop copper, zinc, tin, nickel, gold, and silver deposits in the province of Zamora-Chinchipe. The company has planned an investment of $750 million.

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Table 1.—Other Areas of South America : Production of mineral commodities

Area, commodity, and unit of measure	1976	1977	1978[p]	1979[e]
ECUADOR[1]				
Cadmium, mine output, metal content ---- kilograms	462	476	417	480
Cement, hydraulic ---- thousand metric tons	616	626	1,000	1,000
Clays: Kaolin ---- do	1,138	1,427	1,185	1,000
Copper, mine output, metal content ---- metric tons	267	700	581	700
Gas, natural:				
Gross ---- million cubic feet	[r]11,949	12,290	12,429	12,600
Marketable ---- do	3,713	1,490	[e]1,500	1,600
Gold, mine output, metal content ---- troy ounces	[r]11,014	7,649	3,213	3,500
Gypsum (for cement) ---- metric tons	43,762	43,762	45,359	45,000
Lead concentrates ---- do	168	215	220	220
Natural gas liquids:				
Natural gasoline ---- thousand 42-gallon barrels	128	106	79	100
Liquefied petroleum gas ---- do	39	36	721	800
Total ---- do	[r]167	142	800	900
Petroleum:				
Crude ---- do	[r]68,362	67,002	73,669	85,700
Refinery products:				
Gasoline ---- do	6,079	6,144	7,293	8,500
Jet fuel ---- do	467	537	985	1,000
Kerosine ---- do	1,915	2,381	2,716	3,200
Distillate fuel oil ---- do	2,886	3,234	4,518	5,500
Residual fuel oil ---- do	3,776	6,602	13,018	15,000
Lubricants ---- do	[r]167	194	234	300
Other:				
Liquefied petroleum gas ---- do	40	192	200	200
Unspecified ---- do	20	340	317	300
Refinery fuel and losses ---- do	[r]145	721	1,016	1,000
Total ---- do	[r]15,495	20,345	30,297	35,000
Silica ---- metric tons	NA	10,800	10,000	10,000
Silver, mine output, metal content ---- troy ounces	[r]47,382	57,223	64,000	70,000
Stone, sand and gravel:				
Limestone (for cement manufacture) thousand metric tons	880	920	1,200	1,200
Marble ---- metric tons	182	202	190	180
Sulfur:				
Native ---- do	[e]1,000	[e]1,000	[e]1,000	1,000
Byproduct:				
From petroleum[e] ---- do	5,000	5,000	5,000	5,000
From natural gas[e] ---- do	3,000	3,000	5,000	5,000
Total ---- do	[e]9,000	[e]9,000	[e]11,000	11,000
Zinc, mine output, metal content ---- do	[r]123	1,997	[e]1,200	2,000
FRENCH GUIANA				
Gold, mine output, metal content ---- troy ounces	2,797	4,823	[e]5,000	5,000
Stone, sand and gravel ---- metric tons	NA	329,320	325,000	330,000
GUYANA[1]				
Aluminum:				
Bauxite, dry equivalent, gross weight[e] thousand metric tons	2,686	2,731	2,400	2,400
Alumina ---- do	281	271	250	200
Diamond:[2]				
Gem[e] ---- thousand carats	6	7	7	7
Industrial[e] ---- do	8	10	10	10
Total ---- do	14	17	17	17
Gold, mine output, metal content ---- troy ounces	15,656	11,899	15,396	10,593
PARAGUAY				
Cement, hydraulic ---- thousand metric tons	155	200	166	180
Clays:				
Kaolin[e] ---- metric tons	14,000	22,000	35,380	27,000
Other ---- thousand metric tons	1,100	1,320	1,518	[3]1,870
Gypsum[e] ---- metric tons	16,000	14,000	9,000	9,000
Lime ---- do	31,863	35,049	38,554	45,000
Petroleum refinery products:				
Gasoline ---- thousand 42-gallon barrels	480	648	805	850
Jet fuel ---- do	53	69	75	75
Kerosine ---- do	127	145	151	160
Distillate fuel oil ---- do	899	1,390	1,710	1,700
Residual fuel oil ---- do	287	333	371	370
Liquefied petroleum gas ---- do	39	45	46	50
Refinery fuel and losses ---- do	92	358	467	495
Total ---- do	1,977	2,988	3,625	3,700

See footnotes at end of table.

Table 1.—Other Areas of South America : Production of mineral commodities —Continued

Area, commodity, and unit of measure	1976	1977	1978[p]	1979[e]
PARAGUAY —Continued				
Pigments, mineral, natural: Ocher metric tons	120	120	150	100
Sand, including glass sand[e] thousand metric tons	981	1,401	1,900	[3]2,300
Stone:				
Dimension do	180	144	197	223
Crushed and broken:				
Limestone (for cement and lime) do	277	415	370	[3]300
Other do	2,280	3,500	5,140	[3]5,450
Talc, soapstone, pyrophyllite metric tons	140	130	160	163
SURINAME				
Aluminum:				
Bauxite, gross weight thousand metric tons	[r]4,587	[r]4,856	5,025	5,000
Alumina do	[r]1,162	1,215	1,316	1,250
Metal, primary[4] do	[r]45	58	55	64
Cement, hydraulic do	[e]50	48	60	54
Clays:				
Common metric tons	NA	116,000	[e]115,000	115,000
Kaolin[4] do	--	2,500	2,500	2,500
Gold, mine output, metal content troy ounces	39	376	--	--
Sand and gravel:				
Sand, common thousand metric tons	([5])	NA	160	150
Gravel metric tons	26,000	37,800	30,000	30,000
Stone, crushed and broken thousand metric tons	137	75	40	50
URUGUAY				
Aluminum, secondary do	31	52	45	[e]40
Barite do	--	50	33	35
Cement, hydraulic do	676	682	674	600
Clays, type not specified metric tons	425,704	336,009	339,054	340,000
Coke, gashouse do	11,685	[e]11,685	[e]11,685	11,685
Corundum do	381	421	223	227
Feldspar do	1,145	1,625	1,995	2,700
Fluorspar do	50	75	81	77
Gas, manufactured million cubic feet	753	[e]750	[e]750	750
Gem stones, semiprecious:				
Agate metric tons	35	802	184	200
Amethyst do	2	[e]2	32	33
Iron and steel:				
Ferroalloys: Electric furnace ferrosilicon do	260	105	--	--
Steel, crude do	[r]15,400	17,200	8,700	14,900
Semimanufactures do	34,841	47,265	43,898	[3]50,440
Lime thousand metric tons	70	70	85	81
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	2,051	1,940	2,211	2,300
Jet fuel do	263	269	219	230
Kerosine do	1,326	1,199	1,243	1,200
Distillate fuel oil do	3,365	3,355	3,812	4,000
Residual fuel oil do	5,062	5,170	4,998	5,000
Lubricants do	1	37	39	40
Other:				
Liquefied petroleum gas do	384	397	431	440
Unspecified do	58	287	335	350
Refinery fuel and losses do	229	228	235	240
Total do	12,739	12,882	13,518	13,800
Sand and gravel:				
Sand:				
Common thousand metric tons	1,649	1,885	2,077	2,200
Glass metric tons	--	2,210	1,696	1,700
Gravel thousand metric tons	864	[e]865	341	400
Stone:				
Dimension do	95	18	87	90
Crushed and broken:				
Alum schist metric tons	1,441	2,483	11,392	10,000
Dolomite thousand metric tons	34	95	110	120
Limestone do	859	1,192	1,190	1,100
Marble do	4	4	5	5
Marl metric tons	8,769	900	11,553	10,000
Quartz do	7,024	200	([5])	([5])
Other (including ballast) thousand metric tons	1,115	1,758	1,488	1,500
Sulfur, elemental, byproduct[e] metric tons	2,200	2,200	2,200	2,200
Talc, soapstone, pyrophyllite do	1,268	1,659	1,724	1,800

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities listed, a variety of crude construction materials (common clays, sand and gravel, and stone) undoubtedly is also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] Gem and industrial diamond production is estimated based upon reported total production.

[3] Reported figure.

[4] Data represent exports.

[5] Less than 1/2 unit.

Table 2.—Ecuador: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	Principal destinations, 1976
METALS		
Antimony ore and concentrate	197	Belgium-Luxembourg 164; Spain 32.
Copper:		
Ore and concentrate	1,250	All to Belgium-Luxembourg.
Metal, scrap	5	All to Colombia.
Lead oxides kilograms	100	All to Peru.
Zinc ore and concentrate	245	All to France.
NONMETALS		
Salt	20	All to Panama.
Stone, dimension:		
Crude and partly worked, marble	347	Japan 300; West Germany 47.
Worked	5	Mainly to Spain and Venezuela.
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	63,876	United States 19,413; Panama 13,232; Peru 12,798.
Refinery products:		
Petroleum coke and other bituminous mixtures do	100	All to Panama.

Table 3.—Ecuador: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	Principal sources, 1976
METALS		
Aluminum:		
Oxide (alumina) and hydroxide	17	West Germany 9; United States 8.
Metal including alloys, all forms	3,577	France 1,365; Japan 591; Venezuela 389.
Arsenic:		
Trioxide, pentoxide, acids	5	All from East Germany.
Metal including alloys, all forms kilograms	72	All from West Germany.
Chromium:		
Oxide and hydroxide	41	Argentina 20; United Kingdom 6; West Germay 5.
Metal including alloys, all forms kilograms	90	All from United States.
Cobalt oxide and hydroxide do	171	West Germany 121; Belgium-Luxembourg 50.
Copper:		
Copper sulfate	111	Peru 100.
Metal including alloys:		
Unwrought	67	Colombia 24; Peru 18; Chile 15.
Semimanufactures	1,390	Chile 564; Peru 542.
Gold:		
Unwrought troy ounces	50,798	All from Switzerland.
Semimanufactures value	$50	All from United States.
Iron and steel metal:		
Scrap	10	Do.
Pig iron, ferroalloys, similar materials	150	United States 125.
Steel, primary forms	55,120	United States 36,695; Chile 14,777.
Semimanufactures:		
Bars, rods, angles, shapes, sections	77,128	Japan 51,499; Chile 17,240.
Universals, plates, sheets	56,674	Japan 45,922; Chile 7,010.
Hoop and strip	1,772	Japan 1,500.
Rails and accessories	25	Japan 20.
Wire	2,102	Japan 1,377.
Tubes, pipes, fittings	13,007	Japan 5,993; United States 2,934.
Castings and forgings, rough	567	United States 447.
Lead:		
Oxides	520	Mexico 515.
Metal including alloys:		
Unwrought (including scrap)	339	Peru 297; Panama 42.
Semimanufactures	63	Peru 37; United States 10.
Magnesium metal including alloys, semimanufactures	1	All from West Germany.
Manganese oxides	519	Mexico 475.
Mercury 76-pound flasks	25	West Germany 10; United States 10.
Nickel metal including alloys, semimanufactures	13	West Germany 5; United States 5.
Platinum-group metals including alloys, all forms troy ounces	54,142	United States 52,502.
Rare-earth metals:		
Oxides kilograms	5,000	All from France.
Metals including alloys do	430	Netherlands 300; United States 130.
Silver metal including alloys troy ounces	11,478	Japan 9,066.

Table 3.—Ecuador: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	Principal sources, 1976
METALS —Continued		
Tin:		
Ore and concentrate ... kilograms	1	All from West Germany.
Metal including alloys, all forms	32	Peru 12; United Kingdom 11.
Tungsten metal including alloys, all forms ... kilograms	40	Brazil 28; Italy 12.
Zinc:		
Oxide	267	Peru 152; Mexico 30; United Kingdom 30.
Metal including alloys:		
Scrap	20	All from Peru.
Blue powder	17	All from United States.
Unwrought	637	Peru 585; Mexico 50.
Semimanufactures	49	Belgium-Luxembourg 20; United States 13; West Germany 9.
Other:		
Ores and concentrates:		
Of molybdenum, tantalum, titanium, vanadium, zirconium ... value	$6	All from West Germany.
Other ... kilograms	46	All from United States.
Oxides, hydroxides, peroxides of metals, n.e.s	18	United States 14.
Metals including alloys, all forms:		
Metalloids	3	Colombia 2.
Alkali, akaline earth, rare-earth metals ... kilograms	430	Netherlands 300; United States 130.
Pyrophoric alloys ... do	69	All from West Germany.
Base metals including alloys, all forms, n.e.s	2	Mainly from United States.
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	16	United States 7; Netherlands 5.
Grinding and polishing wheels and stones	115	Brazil 31; West Germany 19; Czechoslovakia 17.
Asbestos	4,994	Canada 3,462; Australia 1,500.
Barite and witherite	593	Mainly from Colombia.
Boron materials:		
Crude natural borates	13	NA.
Oxide, acid, borates, perborates	73	United States 45; West Germany 13.
Cement	222,715	Colombia 167,759; Honduras 28,612.
Chalk	872	Belgium-Luxembourg 648; France 114; Colombia 110.
Clays and clay products (including all refractory brick):		
Crude:		
Bentonite	65	Peru 50; United States 14.
Kaolin	394	United States 362.
Other	413	United Kingdom 396.
Products:		
Refractory (including nonclay brick)	2,699	Colombia 921; United States 737; Venezuela 311.
Nonrefractory	24	Japan 22.
Diamond, all grades ... thousand carats	50	France 15; Switzerland 12; West Germany 10.
Diatomite and other infusorial earth	220	Mexico 162; United States 51.
Fertilizer materials:		
Crude and manufactured:		
Nitrogenous	17,259	Yugoslavia 14,678.
Phosphatic	15,749	United States 15,631.
Potassic	71	Mainly from United States.
Other, including mixed	23,446	United States 22,339.
Ammonia	59	Netherlands 26; United Kingdom 15; West Germany 7.
Graphite, natural	2	United Kingdom 1.
Gypsum and plasters	377	Mainly from United States.
Iodine ... kilograms	354	France 200.
Magnesite	4	West Germany 3.
Mica, all forms	14	Mainly from United States.
Pigments, mineral:		
Natural, crude	39	Italy 15; Spain 13; Belgium-Luxembourg 10.
Iron oxides, processed	110	West Germany 60; Spain 20; Argentina 11.
Salt	5	Mainly from West Germany.
Sodium and potassium compounds, n.e.s	8,846	United States 8,039.
Sulfur:		
Elemental:		
Other than colloidal	2	Mainly from Belgium-Luxembourg.
Colloidal	1,175	Venezuela 988; Netherlands Antilles 112.
Sulfur dioxide ... kilograms	136	All from Brazil.
Sulfuric acid, including oleum	175	Netherlands 85; Japan 48; West Germany 30.
Talc, steatite, soapstone, pyrophyllite	364	United States 251; China, mainland 41.

See footnotes at end of table.

Table 3.—Ecuador: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	Principal sources, 1976
NONMETALS —Continued		
Other:		
Crude	8	Mainly from United States.
Slag, dross, and similar waste, not metal bearing, from iron and steel manufacture	33	All from United States.
Oxides and hydroxides of magnesium, strontium, barium	52	Austria 30; United States 18.
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	2,286	Colombia 1,813; United States 473.
Carbon black and gas carbon:		
Carbon black	1,716	Colombia 755; Venezuela 677; Sri Lanka 209.
Gas carbon kilograms	14	United Kingdom 13.
Coal, anthracite	543	United States 515.
Coke and semicoke	1,095	Mainly from Colombia.
Hydrogen, helium, rare gases kilograms	6,195	Japan 5,670.
Petroleum:		
Crude and partly refined 42-gallon barrels	208	All from United States.
Refinery products:		
Gasoline, aviation do	49,262	Mainly from Netherlands Antilles.
Kerosine do	23	All from United States.
Residual fuel oil do	13	Do.
Lubricants (including grease) do	183,408	Netherlands Antilles 133,966; Venezuela 27,377.
Mineral jelly and wax do	44,631	West Germany 16,086; India 5,784; United States 3,919.
Other:		
Liquefied petroleum gas do	19,906	Venezuela 11,948; Peru 7,958.
Nonlubricating oils, n.e.s do	714	United States 476.
White spirit do	17	All from United States.
Pitch, pitch coke, petroleum coke do	3,108	Colombia 3,009.
Bituminous mixtures, n.e.s. do	351	United States 255.
Total do	301,433	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	280	United States 218.

NA Not available.

FRENCH GUIANA

Except for minor amounts of domestically consumed sand and gravel and crushed stone, gold was the only mineral produced in French Guiana. A rapidly increasing world market price has kindled some interest in gold exploration and development, but the alluvial nature of the country's known deposits and their difficult access remain strong deterrents to large-scale development.

The offshore well drilled in 1978 by Esso Exploration Guyane, S.A.R.L., was abandoned at a depth of almost 13,000 feet after failing to encounter shows of oil or gas.

GUYANA

During 1978 and 1979, Guyana continued its attempts to stabilize a faltering economy. In both years the Government endeavored to follow guidelines set forth by the International Monetary Fund; however, declining bauxite and alumina shipments were among the factors that impeded economic stabilization efforts. In 1978, bauxite exports fell sharply, at first due to a slack market and later because of production problems. In 1979, labor strikes and slowdowns beset the bauxite industry, in addition to an apparent trend toward declining productivity. As a result, Guyana was not able to take full advantage of increased world demand and prices for bauxite.

The growth of the GDP, measured in real terms, was estimated to be zero in 1979, which was nonetheless up from the -6.2% and -1.0% growth estimated for 1977 and 1978, respectively. In 1978, Guyana succeeded in showing a positive balance of trade, but in 1979, soaring petroleum import costs and generally lower bauxite and agricultural exports contributed to a negative trade balance.

In February 1979, the Government announced a new Guyana Investment Code which reversed its policy of requiring government majority interest in joint ventures with foreign companies. The Government further announced its intentions to incorporate various existing and proposed investment incentive laws into one piece of legislation. The extent to which domestic and foreign investors would take advantage of the new investment code was uncertain, although some foreign companies entered into exploration agreements during 1979.

After 5 years of preparation, Guyana Mining Enterprise, Ltd. (GUYMINE), in mid-1979 officially opened the East Montgomery Mine. The mine represented the first expansion of Guyana's bauxite mining industry since 1971. Bauxite reserves at East Montgomery were estimated at 80 million tons with a mine life expectancy of 40 years. Initially, the mine is expected to provide about 12% of Guyana's calcined bauxite production, but this figure is expected to increase to 50% in 10 years. The new mine suffered a minor production setback when a landslide buried 80,000 tons of exposed ore shortly after opening. As with other bauxite mines in the Linden area, 200 to 250 feet of overburden must be removed, and mining activity is complicated as a result. In 1978, Guyana began operations at the Kaiakabra bauxite deposit, where proven ore reserves have been estimated at 500,000 tons of calcine grade bauxite.

Future assessments of total bauxite reserves may be substantially increased due to the inclusion of lateritic ore deposits occurring over 15,000 square miles of the Pakaraima Plateau in western Guyana. Reports on preliminary investigations have indicated the existence of billions of tons of ore that would require little—if any—overburden removal.

In 1978, it was reported that the U.S.S.R. would undertake a feasibility study for construction of a 600,000-ton-per-year alumina plant in Guyana. In 1979, Guyana's alumina capacity was about 300,000 tons per year.

A favorable feasibility study was completed in 1979 for the 750-megawatt Upper Mazaruni Hydroelectric Project, and Guyana has applied to the World Bank for financing. Companion to the hydroelectric project is the construction of a 150,000-ton-per-year aluminum smelter at a projected cost of $800 million. The search for a technological partner for the smelter to share construction costs was scheduled to begin in 1980, contingent upon financing of the hydroelectric scheme by the World Bank. The proposed smelter site on the Demerara River is only a few miles from an existing alumina plant and about 60 miles from the coast.

The Guyanese Government has urged gold miners to step up production in response to the dramatic surge in precious metal prices. In 1979 Guyana granted

Table 4.—Guyana: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal destinations, 1978
METALS			
Aluminum:			
Alumina:			
Hydrated	15,553	12,961	United States 12,961.
Unhydrated	251,861	234,222	Norway 115,613; United Kingdom 37,656; U.S.S.R. 24,740; France 23,163.
Bauxite:			
Calcined	693,466	578,398	United States 215,525; West Germany 83,564; United Kingdom 51,778.
Other thousand tons	882	998	Canada 531; United States 424.
Gold metal, unworked or partly worked, all forms troy ounces	69	39	Canada 39.
Iron and steel semimanufactures	1,045	530	Barbados 237; Trinidad and Tobago 118; Suriname [illegible]
NONMETALS			
Diamond, gem carats	9,025	10,999	Belgium-Luxembourg [illegible]; Netherlands 2,549; United Kingdom 2,246.

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Table 5.—Guyana: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Principal sources, 1978
METALS			
Aluminum metal including alloys, all forms	8,617	382	United Kingdom 323; Japan 21.
Copper metal including alloys, all forms	--	55	United Kingdom 32; Netherlands 22.
Iron and steel metal including alloys, all forms	91,329	1,018,847	United Kingdom 573,690; Japan 372,275.
Lead:			
Oxides	44	231	United Kingdom 178; Trinidad and Tobago 53.
Metal including alloys, all forms	155	127	United Kingdom 78; Trinidad and Tobago 49.
NONMETALS			
Cement	26,585	37,142	Haiti 17,942; Cuba 15,530.
Clay products (including all refractory brick) value, thousands	$504	$969	United Kingdom $402; United States $363; East Germany $202.
Fertilizer materials, manufactured:			
Nitrogenous	24,577	24,027	Trinidad and Tobago 18,639; United States 5,335.
Phosphatic	6,195	2,447	United States 1,761; Dominican Republic 610.
Potassic	3,482	661	West Germany 557.
Gypsum and plasters	69	--	
Lime	4,415	4,359	United Kingdom 2,356; Puerto Rico 1,850.
Salt	5,338	4,090	Canada 3,149; Jamaica 913.
Sodium and potassium compounds, n.e.s.: Caustic soda	106,806	24,086	United States 23,794.
Stone: Limestone (pulverized)	80,658	16,083	Bahamas 14,604.
Sulfuric acid, including oleum	901	43	Venezuela 34; United Kingdom 7.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,329	2,391	Netherlands Antilles 1,902; Trinidad and Tobago 453.
Hydrogen and rare gases	58	55	United States 42; United Kingdom 9.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	364	341	Trinidad and Tobago 330.
Kerosine and jet fuel do	165	176	Trinidad and Tobago 174.
Distillate fuel oil do	1,150	1,005	Trinidad and Tobago 1,005.
Residual fuel oil do	2,518	3,005	Trinidad and Tobago 2,981.
Lubricants do	12	58	Netherlands Antilles 17; Jamaica 12; United States 12.
Liquefied petroleum gas do	63	75	Trinidad and Tobago 33; Netherlands Antilles 26; Venezuela 16.
Mineral jelly and wax do	2	2	United Kingdom 1.
Unspecified do	4	--	
Total do	4,278	4,662	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	150	--	

nonexclusive uranium exploration rights to Compagnie Générale des Matiéres Nucléaires (Cogéma) of France and Grundstofftechnik GmbH of Essen, Federal Republic of Germany. In the late 1960's and early 1970's, results from aerial surveys for uranium were encouraging, but the areas involved difficult access and geological conditions, and no further exploration was undertaken.

In April 1979, Guyana granted a joint offshore exploration concession to Seagull International Exploration, Inc., of Houston, Tex., and Denison Mines, Ltd., of Toronto, Canada. The 4,000-square-mile concession is located about 20 miles offshore between the mouths of the Demerara and Berbice rivers. Deminex Oil Co. abandoned offshore exploration in 1976 after drilling two wells off the Essequibo coast. To retain the concession, Seagull-Denison must drill an exploratory well by the end of 1982. Part of the preparatory work planned by Seagull and Denison includes reevaluations of previous seismic and drilling efforts.

In October 1979, another petroleum exploration agreement was signed with a consortium of four Canadian companies: Home Oil and Gas Co.; Ranger Oil Ltd.; Voyager Petroleum Ltd.; and Norcen International, Ltd. Under the agreement, the Home Oil consortium will explore the Takutu Basin in the Rupununi District bordering Brazil. Drilling was projected to begin in 1981.

In November 1979, the U.S. firm Major Crude Oil Inc. signed a 5-year agreement with Guyana to explore for oil in a 9,830-square-kilometer triangular-shaped area extending from the mouth of the Courantyne River out to the continental shelf. Major's concession adjoins the concession granted to Seagull. Seismic study was scheduled to begin early in 1980. The company has agreed to invest $88 million and drill eight wells to a depth of at least 6,700 meters each.

PARAGUAY

The minerals industry of Paraguay continued to be limited to the production of nonmetallic industrial minerals for domestic consumption. The construction industry maintained its high rate of expansion as a result of the Itaipú hydroelectric and infrastructural projects as well as increased residential and commercial building. The Itaipú project continued to benefit the economy as demands for goods and services brought in large amounts of foreign exchange. However, inflation has accompanied Paraguay's prosperity; the cost of living rose over 10% in 1978 and increased by an estimated 30% in 1979.

The controversy between Argentina and Paraguay over technical specifications for the Yacyretá hydroelectric project appeared to have reached a settlement in mid-1979 when an agreement between the two countries was amended to allow for less flooding of Paraguayan territory and compensation to Paraguay for flooded land. Financing for the project was delayed by the disagreement, and doubts were cast upon the possibility of Paraguay and Argentina reaching an agreement on the proposed Corpus dam, which must also include Brazil and compatibility with the Itaipú project.

The Government confirmed the existence of uranium deposits in eastern Paraguay, but no information was available regarding the extent, quality, or commercial viability of these deposits. Uranium exploration was begun in 1978 by Anschutz Corp. and the Korea Electric Corp. Also in 1978, the Taiwan Power Co. signed a 2-year uranium exploration contract with Paraguay.

The Government signed an agreement with the Brazilian companies Siderúrgica Coferraz, S.A., and Técnica Nacional de Engenharia (Tenenge) to construct Paraguay's first steel plant, at Villa Hayes on the Paraguay River, 20 kilometers north of Asunción. The operating company, Aceros de Paraguay (Acepar), is 60% state-owned, with Coferraz holding 39% interest and Tenenge holding 1% of the remaining interest. Estimated to cost $81 million, the steel mill is planned to have an initial annual capacity of 100,000 tons of nonflat rolled products. Plans are for raw material to be brought down the Paraná River from the Urucum mines near Corumbá, Brazil. The plant has been scheduled to come onstream in 1982.

In 1979, UNC Resources, Inc., signed a renewable 5-year minerals exploration contract with the Government to develop the mineral potential of western Paraguay. Work is expected to begin in early 1980. UNC's concession includes about 55 million acres in the Chaco area, but liquid and gaseous hydrocarbons are excluded from the agreement.

Texaco Paraguay, Inc., and Marathon Oil Co. completed a joint petroleum exploration program in the northern Chaco area after drilling three dry holes in 1978. In 1979, Francana Oil and Gas, Ltd., began a $3.2 million geophysical program on its 28,900-square-mile concession. Francana is 54.9% owned by Hudson Bay Mining & Smelting Co. In 1979, Pectin International, a subsidiary of Shell Oil Co., assumed the exploration rights held in eastern Paraguay by Trend Resources Ltd. Pectin has initiated an extensive seismic program that may lead to drilling by 1981.

Crude oil shortages and dramatic increases in the price of petroleum products spurred interest in developing alcohol as a substitute fuel. In 1979, construction was underway on two ethanol plants that are designed to use sugarcane as raw material. The plants are expected to come onstream

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in 1981. One of these plants, which is owned by the state, is expected to produce 120,000 liters (31,700 gallons) per day of ethanol when fully operational; the other, a privately owned plant, is expected to produce 90,000 liters (23,775 gallons) per day. Plans are for this alcohol to be used as a substitute for gasoline.

Fuel shortages and petroleum import costs in 1979 prompted the Government to increase the domestic price of petroleum derivatives by 60.7% and to enact fuel conservation measures. The Government also ended state-owned Refineria Paraguay-a S.A.'s (REPSA) monopoly over the import and refining of crude oil. A new company, Carburantes del Paraguay, was formed by private interests and was reported to be negotiating for oil imports from Argentina and Brazil.

Table 6.—Paraguay: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1977	1978
METALS		
Aluminum metal, all forms	475	1,529
Copper metal, all forms	2	41
Iron and steel metal, all forms	29,292	25,844
Lead metal, all forms	16	24
Tin metal, all forms	8	8
NONMETALS		
Cement, portland	4,530	58,378
Salt	24,895	23,036
Other, crude	21,848	23,221
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	2,729	3,617
Petroleum:		
Crude ... thousand 42-gallon barrels	1,736	2,451
Refinery products:		
Gasoline ... do	172	244
Distillate fuel oil ... do	520	631
Residual fuel oil ... do	171	124
Lubricants ... do	47	49
Total ... do	910	1,048

[1] In addition to the commodities listed individually, Paraguay reported the importation of "precious stones and metals" totaling 1 ton in 1977 and 4 tons in 1978.

SURINAME

Suriname continued to rely heavily on imported goods and services and was consequently affected by world inflation. For 1978, Suriname's rate of inflation was officially set at 10%, but by mid-1979 the rate had climbed to about 15%.

The burden of sharply increased petroleum prices gave added impetus to interest in hydroelectric development. In 1979, Guyana and Suriname were considering a $1 billion joint hydroelectric project on the Corantijn River. Also, the Kabalebo hydroelectric scheme, considered essential to the development of western Suriname, neared the final phase of financial and environmental impact study. It was estimated that construction could start by the end of 1980.

Tax negotiations between the Government and the Suriname Aluminum Co. (SURALCO), wholly owned by the Aluminum Company of America, ended in August 1979 when a new 3-year bauxite levy agreement was signed. A similar agreement to lower the levy was expected to be concluded with Suriname N.V. Billiton Maatschappij, owned by Royal Dutch Shell. It was anticipated that the reduced levy rate would allow Suriname bauxite to become more competitive in the world market. SURALCO and Billiton account for 85% of Suriname's total exports, about 40% of the tax revenues, and approximately 30% of the GDP. Suriname now produces about 6% of total world bauxite output, but at one time produced 25%.

In July 1978, Suriname and Venezuela signed an agreement to cooperate in bauxite mining and processing technology. Also in July, representatives of several Japanese companies discussed the possibility of investing in the development of the bauxite deposits in western Suriname. A favorable pre-feasibility study by Billition International was completed and a comprehensive study partially funded by Dutch sources was expected to be initiated.

Both Uranerzbergbau GmbH, of the Federal Republic of Germany, and the French State-owned Cogéma were interested in uranium deposits in western Suriname. Gold exploration in the rivers of southern Suriname was begun in 1978 by the Paramaribo Mining Co. It was reported that the company would invest $16.9 million in the venture. No reports have been made available regarding discoveries. In 1979, the United Nations Development Program began discussions with the Government on the possibility of copper exploration in western Suriname. Prior investigation had revealed indications of deposits in the Bakhuys area.

The multinational consortium headed by Esso Petroleum Suriname N.V. abandoned its search for offshore petroleum in 1978. The Venezuelan company Petrolera Las Mercedes S.A. continued onshore geophysical work. In mid-1979, Gulf Oil Corp. held discussions regarding a drilling concession off the coast of the districts of Saramacca and Coronie.

Table 7.—Suriname: Exports of aluminum[1]

(Metric tons)

Commodity	1976[r]	1977	Principal destinations, 1977
Bauxite	2,012,589	2,206,116	Mainly to United States.
Alumina	1,078,481	1,059,366	United States 393,654; Netherlands 218,201; Norway 169,420; United Kingdom 115,157.
Aluminum metal including alloys, all forms	46,296	57,702	Netherlands 33,332; United States 12,381.

[r] Revised.

[1] Compiled from export statistics of trading partners.

Table 8.—Suriname: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
METALS			
Aluminum metal including alloys, all forms	286	322	United States 193; Netherlands 54.
Copper metal including alloys, all forms	68	147	Netherlands 119; United States 21.
Iron and steel metal:			
Scrap	5,641	10,965	Netherlands 4,582; Belgium-Luxembourg 4,305.
Pig iron, ferroalloys, similar materials	6,244	11,494	Belgium-Luxembourg 3,708; Austria 3,541; Netherlands 2,618.
Steel, primary forms	5,172	4,031	Netherlands 1,531; United States 1,009; China, mainland 369.
Semimanufactures	4,383	5,491	Netherlands 1,578; United States 1,221; West Germany 751.
Lead metal including alloys, semimanufactures	23	24	Mainly from the Netherlands.
Nickel metal including alloys, semimanufactures	2	23	Mainly from West Germany.
Tin metal including alloys, semimanufactures	5	4	Netherlands 3.
Zinc metal including alloys, semimanufactures	3	4	Netherlands 3; United States 1.
Other base metals	(1)	(1)	Mainly from Netherlands and United States.
NONMETALS			
Abrasives, natural, n.e.s.:			
Dust and powder of precious and semiprecious stones	1	6	Netherlands 4; United States 2.
Grinding and polishing wheels and stones	(1)	(1)	All from Mexico.
Other	36	497	Mainly from United States.
Asbestos, mica, graphite, magnesite	(1)	1	Netherlands 1.
Cement	392	239	Belgium-Luxembourg 208; Netherlands 31.
Chalk	42,385	55,874	Spain 49,030; Colombia 3,471.
Lime	3,866	8,411	Albania 5,500; United States 2,732.
Salt	1,521	1,233	West Germany 904; Netherlands 296.
Stone, sand and gravel:			
Crude and partly worked	78,602	66,141	Dominican Republic 38,338; United States 16,726; Trinidad and Tobago 9,388.

See footnotes at end of table.

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Table 8.—Suriname: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Principal sources, 1977
NONMETALS —Continued			
Stone, sand and gravel —Continued			
Worked	42	45	Netherlands 25; Canada 8; Italy 7.
Sulfur, elemental, all forms	1,539	1,562	United States 1,380; Netherlands 142.
Other building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	1,445	2,578	Colombia 1,676; United States 346; Netherlands 329.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,188	2,189	Trinidad and Tobago 1,965.
Coal, all grades	31,060	31,283	Mainly from United States.
Petroleum refinery products:[2]			
Gasoline:			
Aviation thousand 42-gallon barrels	[3]12	19	Trinidad and Tobago 16; Netherlands 3.
Motor do	251	316	Mainly from Trinidad and Tobago.
Kerosine and jet fuel do	106	129	NA.
Distillate fuel oil do	1,056	1,275	Trinidad and Tobago 633; Netherlands Antilles 206.
Residual fuel oil do	2,205	2,106	NA.
Lubricants do	[e]32	43	Jamaica 18; Netherlands 18.
Other do	[e]114	133	NA.
Total do	3,776	4,021	

[e] Estimate. NA Not available.

[1] Less than 1/2 unit.

[2] Source for totals is the International Petroleum Annuals 1976 and 1977, but the principal sources were derived from official Surinam trade statistics.

[3] No aviation gasoline was reported in the International Petroleum Annual 1976. Figures were taken from the official Surinam trade statistics.

URUGUAY

Uruguay's economic growth rate fell to a low of 2.3% during 1978, but in 1979 the GDP was estimated to have increased by 8%. The country's 45% rate of inflation in 1978 and the 1979 rate of 84% indicated the failure of Government-initiated anti-inflationary measures. Increased inflation was partially caused by a lifting of price controls on many basic items and increased petroleum prices, but was mainly attributed to the surge, of Argentine tourists who indulged in large-scale spending. Uruguay's trade deficit was about $72 million for 1978, but in 1979 it was estimated to have increased to as much as $250 million. This increase was not entirely due to the increased costs of petroleum imports; it was also caused by the overall expansion of the economy and a tariff reduction program initiated in December 1978.

As 1979 became the year of the seller's market for petroleum, Uruguay found that its policy of operating independently in the petroleum market was disadvantageous. Without long-term contracts and with suppliers defaulting on short-term orders, Uruguay was forced to purchase oil on the escalating spot market. As a result, petroleum represented almost a third of the country's import spending in 1979. To avoid a repetition of 1979's petroleum squeeze, the Government opened an embassy in Saudi Arabia. One objective was to establish closer contact with producers, which could help eliminate the necessity for spot purchases. Fuel conservation measures were initiated to curb manufacturing demand, decrease public service consumption, and lower speed limits on highways.

The prospects of Uruguay having commercial quantities of crude oil dimmed in 1978 after the Administracíon Nacional de Combustibles, Alcohol y Portland (ANCAP) drilled two dry holes in the Santa Lucía River basin 50 kilometers north of Montevideo. In 1978, Argentina's Yacimientos Petroliferos Fiscales undertook an evaluation of the area's petroleum potential and their negative finding, plus ANCAP's two dry holes, led to Uruguay's decision to abandon the Santa Lucía River basin as a potential source of crude oil.

Chevron's decision to withdraw from its offshore drilling contract was made final in early 1978, and Uruguay ended 1979 with no active petroleum drilling underway. In 1979 ANCAP contracted with the Bureau d'Etudes Industrielles et de Cooperation de l'Institut Francais du Petroleo to study offshore petroleum possibilities in Block III, an area which abuts Brazil's territorial waters. Also in 1979, ANCAP contracted with Resources Engineering and Management International, Inc., for an overall evaluation of existing data on Uruguay's petroleum potential on the continental shelf.

The joint Uruguay-Argentina Salto Grande hydroelectric complex was inaugurated in mid-1979. Argentina financed 65% of the $1.5 billion cost and will receive, by agreement, 83.34% of the power generated during the first 15 years of operation. Plans are for Argentina's share to be gradually reduced until it reaches 50% in 1995. Full capacity is not expected to be reached until 1981. Under the joint agreement, Uruguay will not receive enough of Salto Grande's power during the first years of operation to solve its immediate shortage of electricity. Very low reservoir levels caused by a severe drought at one hydroelectric facility and a lengthy repair shutdown at a thermoelectric plant necessitated severe power curtailments to private citizens and caused some industrial disruption. The Palmer hydroelectric project was in the beginning stages of construction during 1979, with completion scheduled for 1982.

Feasibility studies continued throughout 1978 and 1979 for the development of iron ore deposits at Arroyo Valentines. In 1978, ore samples were shipped to Europe for assay, and the results were reported as technically favorable. Further studies were underway in 1979. In late 1979, prequalifying bids were accepted from companies interested in developing the deposits. In 1979, it was reported that the International Iron Co. Inc. will build a $30 million high-carbon ferromanganese plant at Nueva Palmira. It is planned that the plant, which is scheduled to become operational by 1981, will have two electric furnaces and an ultimate capacity of 80,000 tons per year of ferroalloys. Initial capacity is expected to be 40,000 tons per year.

In 1978, Uruguay declared that increased production and export of semiprecious stones were important to the national interest. As encouragement, the Government lifted all import taxes for 2 years on capital goods used by this underdeveloped industry. Amethyst and agate found in the Department of Artigas are the two stones exported.

In 1979, the Federal Institute for Geosciences and Natural resources, Bundesanstalt für Geowissenschaften und Rohstoffe of the Federal Republic of Germany, began investigations of nonmetallic mineral deposits in Uruguay. This work was scheduled to be completed in September of 1980.

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[1] Physical scientist, Branch of Foreign Data.

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The Mineral Industry of Other South Pacific Islands

By Charlie Wyche[1]

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FIJI

Principal mineral products in the Dominion of Fiji were gold, silver, pit and quarry construction materials, and cement. In the years 1978-79, the combined total value of these commodities accounted for some $15 million,[2] or 85% of the total mineral output. Production of cement, sand and gravel, and quarry products increased substantially, but gold and silver output from Fiji's only operating metal mine continued the downward trend of recent years.

Mineral exploration by several international mining companies as well as by local prospectors was being carried out over much of Fiji, and a number of interesting prospects were discovered. One of these, a medium-size porphyry-copper prospect in the Namosi area of Viti Levu, was at a mining feasibility study stage. At Mount Kasi on Vanua Levu, an extensive program of geological sampling and mapping was being conducted, and surface sampling and drilling was taking place at some base metal prospects in the south-central parts of Viti Levu. Also, high gold values in surface samples were reported at Vuda in western Viti Levu.

At yearend, 39 mineral prospecting licenses, covering 4,220 square kilometers, and 4 offshore petroleum prospecting licenses, covering 30,850 square kilometers, were in force. Total exploration expenditure by United States, Australian, United Kingdom, French, and the Federal Republic of Germany interests exceeded $8,000,000 for the 1978-79 period.

In late 1978, the Mineral Resources Department took delivery of a fully operational research vessel, the *RV Bulikula*. The ship was designed and built in Fiji and equipped with a satellite navigational system which would facilitate a variety of offshore mineral investigations.

Table 1.—Other South Pacific Islands: Production of mineral commodities

Area, commodity, and unit of measure	1976	1977	1978[p]	1979[e]
FIJI				
Cement, hydraulic metric tons	69,000	77,488	82,000	95,000
Gold, mine output, metal content troy ounces	65,757	49,067	28,065	25,000
Lime[1] metric tons	2,666	1,997	835	850
Silver, mine output, metal content troy ounces	19,773	14,695	10,415	10,500
Stone, sand and gravel:				
Coral sand for cement manufacture metric tons	78,316	107,861	88,104	100,000
River sand for cement manufacture do.	52,783	41,494	59,515	50,000
River sand and gravel, n.e.s. cubic meters	851,762	562,898	310,041	350,000
Quarried stone do.	181,683	107,098	[e]120,000	120,000
Tellurium metal kilograms	[r]2,446	[e]12,250	[e]22,700	22,700
NAURU AND OCEAN ISLAND[2]				
Phosphate rock, marketable:				
Nauru[3] thousand metric tons	755	1,146	1,999	2,000
Ocean Island do.	417	446	465	500
NEW CALEDONIA				
Cement metric tons	54,180	50,605	55,000	60,000
Chromium: Chromite, gross weight do.	9,537	6,310	8,229	8,165
Cobalt, mine output:[4]				
Content by analysis do.	4,569	4,497	2,535	3,100
Recovered do.	80	110	155	210
Giobertite do.	653	--	--	--
Nickel:				
Ore:				
Gross weight thousand metric tons	5,921	5,839	3,370	5,100
Metal content[5] metric tons	109,912	105,106	66,099	[e]81,226
Metallurgical products, metal content:				
Of ferronickel do.	38,152	28,283	19,889	31,100
Of matte do.	23,759	23,088	17,103	[e]19,562
Total do.	61,911	51,321	36,992	[e]50,662
Stone, sand and gravel:				
Stone:				
Crude (unspecified) cubic meters	38,000	42,000	50,000	50,000
Crushed do.	108,000	130,000	140,000	135,000
Sand do.	63,000	72,000	85,000	75,000
Silica (for metallurgical use) do.	28,862	27,000	29,000	30,000
NEW HEBRIDES[2]				
Manganese:				
Ore[6] metric tons	[r]217,000	158,000	133,000	112,259
Concentrate, gross weight[7] do.	35,075	24,717	21,511	[e]10,791
PAPUA NEW GUINEA[2]				
Copper, mine output, metal content do.	175,806	[r]182,291	198,603	[e]170,788
Gold, mine output, metal content troy ounces	[r]668,014	739,730	751,265	700,000
Silver, mine output, metal content do.	[r]1,451,000	1,522,750	1,708,481	1,500,000
SOLOMON ISLANDS[2]				
Gold do.	600	372	[e]400	400

[e] Estimate. [p] Preliminary. [r] Revised.

[1] Produced from an unreported amount of domestically quarried limestone.

[2] In addition to the commodities listed, crude construction materials (common clays, sand and gravel, and stone) are produced, but output is not reported quantitatively and available general information is inadequate to make reliable estimates of output levels.

[3] Data represent exports.

[4] Data series is revised to reflect total cobalt content of nickel ores mined and cobalt actually recovered from these ores and/or from intermediate metallurgical products derived from these ores. Data reported in previous editions of this chapter on cobalt contained in metallurgical products of nickel are misleading because this cobalt content was not recovered for use.

[5] Nickel-cobalt content of metallurgical plant products, plus nickel-cobalt in exported ores.

[6] Reported figure.

[7] Data represent Japanese imports.

COMMODITY REVIEW

Metals.—*Copper.*—Copper Resource Ltd. finalized a preliminary study on the economics of the Namosi deposit on Viti Levu. The investigation, which included diamond drilling, collection of baseline environmental data, and geological sampling, indicated an ore body of 450 million tons at 0.4%-0.5% copper. The investigation also indicated that the deposit was minable by open pit, with a waste-to-ore ratio of around 2:1. Copper Resource Ltd. (a subsidiary of Conzinc Riotinto of Australia Ltd.) replaced Amax Exploration (Australia) Inc. as project manager. Other partners in the consortium included Anglo Pacific (Namosi) Ltd., subsidiary of Australian Anglo American Ltd., and Preussag Fiji Ltd. of the West German Preussag Group.

Gold.—Emperor Gold Mining Co. Ltd., the wholly owned operating subsidiary of Emperor Mines Ltd., continued to mine sulpho-telluride gold ores at Vatukoula on the north coast of Viti Levu. During 1978-79, the company employed 690 men to mine and treat about 325,000 tons of ore for a recovery of some 53,000 troy ounces of gold and 21,000 troy ounces of silver. The lower mine production compared with previous years was mainly due to the company's decision to reduce the underground work force in an effort to cut operating losses.

Labor problems existed at Emperor Gold Mines the past several years, and the company was considering closing the mine owing to heavy financial losses. To keep the mine operating, the Government continued to grant financial assistance in the form of tax relief and interest-free loans. Although the gold price was increasing, losses were incurred because of the declining millhead grades. The company considered a cutoff grade of 0.33 troy ounce per ton would be necessary to maintain a viable operation.

Measured underground ore reserves on June 30, 1979, were 686,867 tons at a cutoff grade of 0.27 troy ounce per ton.

Pacific Energy and Minerals Co. of Golden, Colo., started prospecting for gold near the Vatukoula gold mine. The company, under the name of Aurelia Resources Ltd., applied for licenses to prospect for precious metals in the southeastern area of Viti Levu. In this area, Fiji Mineral Resources Department reported traces of gold.

Other foreign companies, including Consolidated Gold Fields of Australia (CGFA), also applied for gold prospecting licenses. CGFA expects to explore the islands of Kadavu and Ono, which are 80 kilometers from Suva where gold was reported.

The Anglo American Corp. group recently completed a year of drilling at the Mount Kasi gold mine site on Vanua Levu, the country's second largest island.

Nonmetals.—Emperor Gold Mines continued to produce burnt lime from its limestone quarry at Tau but did not report production. The number of sand and gravel licenses granted continued to increase, although new procedures providing for determination of compensation for damages to fishing grounds were in force.

Fiji Industries Ltd. dredged 86,717 tons of coral sand from Suva Harbor and 58,578 tons of common sand and gravel from the Rewa River and its tributaries in 1978.

The Government's Mineral Resources Division was evaluating a phosphate clay deposit on the island of Tuvutha and reported resources of 1.5 million tons containing 10% P_2O_5.

Mineral Fuels.—*Petroleum.*—Mapco Ltd. and Pacific Energy & Minerals Ltd. were recently granted a license by the Government to carry out extensive oil exploration in four areas known as Bligh Water, Yasawa, Lomaiviti, and Great Sea Reef. Another application was under consideration. Assessment of seismic and other available geological information was in progress, and further surveys were being carried out in preparation for major programs of offshore drilling.

Table 2.—Fiji: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1975	1976
METALS		
Aluminum metal including alloys, all forms	6	1
Copper metal including alloys, all forms	84	81
Gold bullion troy ounces	68,756	65,757
Iron and steel metal:		
Scrap	1,994	847
Steel, primary forms	33	4
Semimanufactures	168	161
Lead metal including alloys, all forms	55	52
Silver bullion troy ounces	44,471	23,573
Titanium oxide	(1)	1
NONMETALS		
Abrasives, natural, n.e.s value	$226	--
Cement	11,908	8,189
Clay products (including all refractory brick):		
Refractory (including nonclay brick) value	$632	$449
Nonrefractory do	$5,167	$9,857
Diatomite and other infusorial earth do	--	$111
Fertilizer materials, manufactured:		
Nitrogenous	--	15
Other, including mixed value	--	$82

See footnotes at end of table.

Table 2.—Fiji: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity		1975	1976
NONMETALS —Continued			
Lime	value	$24	--
Salt		(1)	11
Sodium compounds: Caustic soda		(1)	(1)
Stone, sand and gravel	value	$486	$4,272
Sulfuric acid	do.	$290	$29
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		(1)	--
Hydrogen, nitrogen, rare gases	value	$3,944	$1,745
Petroleum refinery products:			
Gasoline, including natural:			
Motor	thousand 42-gallon barrels	124	115
Aviation	do.	25	11
Kerosine and jet fuel	do.	612	761
Distillate fuel oil	do.	282	288
Residual fuel oil	do.	142	71
Lubricants	do.	2	2
Other:			
White spirit	do.	5	6
Liquefied petroleum gas	do.	1	1
Total	do.	1,193	1,273
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	value	$58	$82

[1] Less than 1/2 unit.

Table 3.—Fiji: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1975	1976
METALS			
Aluminum metal including alloys, all forms	value	$436	$597
Copper metal including alloys:			
Matte		--	1
Scrap		11	(1)
Unwrought and semimanufactures		62	53
Gold metal, unworked or partly worked	troy ounces	1,072	1,984
Iron and steel metal:			
Scrap		(2)	27
Pig iron including cast iron		64	132
Ferroalloys and similar materials	value	$3,690	$16,814
Steel, primary forms		2,891	9,570
Semimanufactures:			
Bars, rods, angles, shapes, sections		4,599	3,290
Universals, plates, sheets		5,835	10,812
Hoop and strip		118	258
Rails and accessories	value, thousands	$1,062	$241
Wire		1,742	2,693
Tubes, pipes, fittings		[3]737	[4]811
Castings and forgings, rough	value, thousands	$13	$96
Lead metal including alloys, all forms	do.	$129	$102
Nickel metal including alloys, all forms	do.	$2,582	$3,651
Platinum-group metals including alloys	troy ounces	93	66
Tin metal including alloys, all forms	value	$51,871	$106,734
Titanium oxides		83	187
Zinc metal including alloys:			
Scrap	value	$299	$10,814
Blue powder	do.	$2,664	$20,546
Unwrought		25	70
Semimanufactures	value	$4,304	$14,751
Other:			
Ores and concentrates and ash and residue	do.	$599	$234,494
Oxides, hydroxides, peroxides of metals	do.	$45,161	$41,720
Metals including alloys, all forms: Pyrophoric alloys	do.	$3,206	$567
NONMETALS			
Abrasives, natural	do.	$115,183	$120,135
Asbestos	do.	$138	$59
Barite and witherite		2	13
Cement		305	3,514
Chalk, earth colors, etc		73	110

See footnotes at end of table.

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Table 3.—Fiji: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1975	1976
NONMETALS —Continued		
Clays and clay products (including all refractory brick):		
Crude	32	29
Products:		
Refractory (including nonclay brick) value	$217,470	$89,504
Nonrefractory do	$385,018	$283,326
Diamond, industrial do	$293	$544
Diatomite and other infusorial earth	138	56
Fertilizer materials:		
Crude:		
Nitrogenous	--	25
Potassic	421	301
Manufactured:		
Nitrogenous	28,007	23,304
Phosphatic	6,860	3,868
Potassic	2,691	1,621
Other, including mixed	411	794
Graphite, natural value	$910	$953
Gypsum and plasters	2,491	281
Precious and semiprecious stone, except diamond value, thousands	$2,795	$4,100
Salt	2,171	2,547
Sodium compounds: Caustic soda	326	786
Stone, sand and gravel:		
Dimension stone and gravel value	$56,200	$16,905
Sand, excluding metal bearing	183	66
Sulfur, including sulfuric acid value	$53,164	$69,129
Other:		
Crude do	$7,295	$3,573
Slag, dross, and similar waste, not metal bearing do	$2,969	$428
Unspecified do	$14,104	$11,682
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	37	655
Coal, coke, peat	16,806	9,390
Hydrogen, nitrogen, rare gases value	$18,692	$37,398
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	3	(1)
Petroleum refinery products:		
Gasoline, including natural:		
Motor do	432	343
Aviation do	12	27
Kerosine do	141	126
Jet fuel do	742	633
Distillate fuel oil do	1,042	881
Residual fuel oil do	215	139
Lubricants do	39	27
Other:		
Liquefied petroleum gas do	17	20
Naphtha do	19	19
Unspecified do	15	2
Total do	2,674	2,217
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals value	$16,474	$21,960

[1] Less than 1/2 unit.

[2] Value only reported at $13.

[3] Partial figure; reported quantity is valued at $483,779 and excluded an unreported quantity valued at $346,055.

[4] Partial figure; reported quantity is valued at $435,155 and excluded an unreported quantity valued at $345,630.

NAURU AND OCEAN ISLAND

The Republic of Nauru and Ocean Island (the latter a member of the Gilbert and Ellice Islands Colony) lie just south of the equator, halfway between Honolulu, Hawaii, and Melbourne, Australia. Responding to increased demand in Australia, phosphate rock production from these two islands (primarily Nauru), by Nauru Phosphate Corp., increased significantly over that of 1977.

Of the 4.9 million tons produced in 1978 and 1979, some 60% went to Australia, 30% to New Zealand, and the remaining 10% to Japan and South Korea. The price for Nauru's phosphate generally follow Florida price trends, with allowance for quality.

As a majority of the phosphate was mined from between limestone pinnacles using grab buckets, means were being investigated to recover the residual phosphate estimated to be 6% to 7% of the total.

Present reserves of phosphate rock in Nauru were estimated at 38 million tons.

Table 4.—Nauru and Ocean Island: Exports of phosphate rock, by destination

(Thousand metric tons)

Destination	Nauru		Ocean Island	
	1977	1978	1977	1978
Australia	660	1,259	277	302
Japan	85	92	--	--
Korea, Republic of	42	39	--	--
New Zealand	359	609	141	166
Total	1,146	1,999	418	468

Source: International Superphosphate and Compound Manufacturers' Association, Ltd.

NEW CALEDONIA

New Caledonia's mineral activity consisted of the mining and smelting of nickel to matte and ferronickel, byproduct cobalt matte from the nickel smelting operations, chromite, and pit and quarry construction materials. The lack of nickel demand throughout 1978 and most of 1979 had an adverse effect on the country's nickel industry. As a result, output by Société Métallurgique le Nickel (SLN), New Caledonia's only producer of nickel products, declined to its lowest level in 10 years. Nickel ore exports were also lower than in 1977.

Nickel ore was produced at four major locations, three (Thio, Kouaoua, and Poro) near the east coast and one (Népoui) near the west coast. Work to expand output at Népoui to 2 million tons of ore per year and at Kouaoua to 1.5 million tons per year was continuing. Combined production of nickel ore for 1978-79 was only 44% above that of 1977.

In 1978, the island's only smelter, the Doniambo facility at Neumea, was closed for 50 days following a strike. When operation was resumed in midyear, the smelter operated at less than 60% of rated capacity during the remainder of 1978. The idle capacity resulted in a sharp decline in production of nickel, nickel matte, and ferronickel. Output in 1979 showed a slight improvement but was substantially below that of 1977.

Exports in 1978 were valued as follows (in thousands): Ore, $31,723;[3] matte, $56,827; and ferronickel, $97,863. Exports in all categories showed improvement in 1979.

The cobalt content of the nickel ore mined in New Caledonia for 1978 and 1979 was estimated at about 1,500 tons. The cobalt content in either the total ore production or in the intermediate metallurgical products was recoverable as cobalt or cobalt chemicals. A significant part of the total remained in nickel products.

Amax Nickel Inc. and Bureau de Recherches Géologiques et Minières (BRGM), the French Government-controlled agency, signed a final agreement leading to a joint development of an integrated nickel project in the Tiebaghi, Poum, and Isle d'Art regions at the northern end of New Caledonia. The agreement covers feasibility and financing studies and ultimate mine and plant construction and operation. The cost of the project was estimated at $600 million. Reserves of 55 million dry tons of ore at 2.5% nickel in garnierite, including 10 million tons of 3% nickel, would be mined at a rate of 1 million tons per year. Amax was interested in shipping nickel matte from this smelter to its Port Nickel refinery in Louisiana.

Inco Ltd. of Canada, under agreement with the New Caledonian Government, was studying the possibility of development of lateritic nickel deposits in the southern part of the island. Inco would be required to take a French partner before the development stage.

Production of chromite ore in 1978, containing 39.5% Cr_2O_3, in the Tiebaghi region, increased 16%, compared with that of 1977. Chromite exports, principally to Japan, had a combined value of $222,000 during 1978 and 1979. Société de la Tiebaghi, subsidiary of Inco Ltd., continued a drilling program that began in 1977.

The BRGM studied chromite prospects in peridotitic rocks along the southern coast.

Energy requirements were considered a potential problem since New Caledonia had no domestic energy resources. Light fuels were imported from Singapore, fuel oil from Australia, and industrial fuel from Bahrain. The Plaine des Lacs region was considered to have hydroelectric development potential. SLN used 85% of the industrial electricity in its mining and smelting operations.

Table 5.—New Caledonia: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978
Chromite, gross weight (50.045% Cr_2O_3)	9,105	4,734	4,345
Nickel ore, gross weight[1] thousand tons	2,693	2,604	1,540
Smelter products, Ni content:[2]			
Ferronickel:			
Electric grade (FN4 grade, 25.1% Ni-Co)	10,305	NA	NA
Sulfur-extracted grade (FN3 grade, 24.5% Ni-Co)	6,151	NA	NA
Refined grade (FN2 grade, 26.3% Ni-Co)	NA	NA	NA
Overrefined grade (FN1 grade, 27.5% Ni-Co)	3,622	NA	NA
Other:			
FN5 grade, Ni-Co content not specified	--	NA	NA
FNC grade, Ni-Co content not specified	10,136	NA	NA
Total ferronickel	30,214	29,465	25,241
Nickel matte (79% Ni-Co)	21,276	23,991	16,511

NA Not available.

[1] Ni-Co content is reported as follows, in tons: 1976—47,984; 1977—46,787; and 1978—28,025.

[2] Co content of smelter products is not available.

Table 6.—New Caledonia: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1974	1975	1976
Cement	96,712	53,116	43,495
Coal	108,865	--	--
Coke	18,858	11	--
Gypsum	13,535		
Iron and steel semimanufactures:			
Bars	6,014	5,915	4,872
Angles, shapes, sections	3,578	2,251	2,261
Plates and sheets	6,021	4,250	4,842
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	346	415	460
Kerosine do.	37	32	37
Distillate fuel oil do.	1,068	403	383
Residual fuel oil do.	4,183	4,305	3,513

Source: Service de la Statistique. Annuaire Statistique de la Nouvelle Caledonie 1977, Nouméa. 1977, pp. 175-176.

NEW HEBRIDES

Production of manganese concentrate, the New Hebrides' only significant mineral product, ceased in November 1978. The only mine, located at Forari, 55 kilometers northwest of Port Vita on Vate (Efaté) Island, was operated by Le Manganese de Vate (LMV) and owned by Southland Mining Ltd. of Australia (87.5%) and public shareholders (12.5%). The decline in world steel production in 1977, which continued throughout 1978, resulted in low demand for the manganese. The mine is expected to reopen at some future date, although only some 120,000 tons of commercially minable reserves remain in the Forari mine. Japan purchased the total manganese output in 1978, which dropped 13% compared with that of 1977. The company had 100 employees, largely native New Hebrideans, and shipped a 40%-42% manganese concentrate of metallurgical grade. The market value was $35 per ton for 40% manganese product.

Although manganese concentrate was the only mineral produced for export in 1978, various mineral deposits were being exploited and others were the subject of investigation during 1978 and 1979. Samples of pozzolan, a consolidated volcanic ash, on Efaté and other islands, were being evaluated in Australia and Fiji for use in cement. Sand, limestone, coral reef, and gravel were used in road building, house construction, the building of airfields and other public works. Other resources included zinc, limestone, and copper on Santo Island, sulfur on Vanua Lava, and beach sand deposits containing magnetite, ilmenite, and other ore mineral on Pentecôte Island. None of these commodities was expected to be mined in the foreseeable future.

PAPUA NEW GUINEA

Papua New Guinea's (PNG) principal mineral products were copper, gold, and silver. Except for a relatively small output of gold in the Bulolo-Wau area, these commodities were produced by Bougainville Copper Ltd.'s mine at Panguna on North Solomon Island (Bougainville). They contributed significantly to Government revenues and the gross domestic product (GDP), estimated at $1,700 million[4] in 1978. Values of 1978 output were as follows: Copper, $184 million; gold, $134 million; and silver, $8 million. Total production value of $326 million was nearly 19% of the GDP. The only other minerals produced were small quantities of limestone and sand for local use. Despite the mineral industry's importance financially, it employed only about 7,200 people out of a total work force of over 350,000.

In 1979, the Government enacted legislation relating to the exploitation of mineral resources, including petroleum. Development of mining and petroleum projects were considered to be of the highest priority, and the basic principles of the legislation adopted were as follows:

Mineral resources belong to the people of Papua New Guinea and the Government, and the people must receive a fair price in return for extraction of the minerals.

Foreign enterprises exploiting Papua New Guinea's mineral resources deserve a reasonable return on their investment, but extraordinary gains above a reasonable return on investment will go in large part to the Government.

The Government has the right to regulate extractive enterprises so as to maximize the benefits to the local community while minimizing the potentially harmful social and economic costs.

A number of probable porphyry copper prospects were under investigation in 1978 and 1979. Some of these copper deposits contained potentially byproduct gold, silver, and/or molybdenum. Exploration was also underway for chromite, nickel, and hydrocarbon products.

COMMODITY REVIEW

Metals.—*Chromite.*—Nord Resources Corporation has found chromite mineralization in several areas of Papua New Guinea and was planning further detailed studies. The find was on parts of a 246-square-kilometer concession in the Ramu River area, close to the deepwater port of Madang. Amax Exploration Australia Inc., a subsidiary of Amax Inc., was evaluating chromite and other minerals in beach sands along the Morobe coast, between Salamaua and Salua. Preliminary estimates indicated reserves of 200 million tons of mineralized sands containing 1.5% chromium.

Copper.—Bougainville Copper Pty. Ltd.'s (BCL) copper mine at Panguna remained the only significant mining operation in Papua New Guinea. While the 1978 output of copper, gold, and silver was significantly above that of 1977, output in 1979 declined to the 1977 level. This resulted from a decline in both tonnage and grade of ore milled. Total ore milled dropped some 2 million tons in 1979 (36.17 million tons), compared with 1978 (38.12 million tons). Copper content declined from 0.60% in 1978 to 0.55% in 1979; gold, from 0.026 troy ounce per ton to 0.024 troy ounce per ton; and silver, from 0.058 troy ounce per ton to 0.054 troy ounce per ton. This trend could continue as mining operations extend into the lower grade sections of the ore body. At yearend 1979, ore reserves at Panguna were placed at 720 million tons at an average grade of 0.44% copper and 0.49 gram per ton gold.

In 1978, sales totaled 193,050 tons of copper, and 730,624 troy ounces of silver. Concentrates were shipped under long-term contracts to Japan, the Federal Republic of Germany, and Spain.

A major factor that contributed to the increased output in 1978 was the completion of a program that added 43 large-capacity dump trucks to the company's inventory. In the concentrator, production was raised by the addition of another ball mill, together with a program to increase the operating speed on all ball mills. The mill throughput was increased by about 3% without and falloff in grinding performance.

Bougainville Copper Ltd. signed a 3-year contract in March, to sell copper to Mainland China. The company will supply about 30,000 tons of copper concentrates to China each year, worth a total of some $45 million. The price was related to the London Metal Exchange copper price.

The feasibility study of the OK Tedi porphyry copper deposit in Papua New Guinea was continued. The study was being carried out by a consortium under the leadership of Broken Hill Pty. (BHP), which began to work at OK Tedi in 1976. The consortium consisted of Dampier Mining Co. Ltd., a subsidiary of BHP Co. (30%)

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Mount Fubilan Development Co. Pty. Ltd., a subsidiary of Amoco Minerals Ltd. (30%); Kupferexploration GmbH, a West German group, (20%); and PNG Government (20%). Situated in the Star Mountains near the West Irian border, the deposit has ore reserves estimated at 300 million tons. Ore grade averaged 0.85% copper, and 55 grams per ton gold, with some molybdenum. Under the agreement with Papua New Guinea, the consortium presented the feasibility study to the Government on May 31, 1979. It was widely believed that the report would recommend that the project be developed, possibly by working the gold-rich part of the ore body first. In February 1979, a hydrographic, geophysical, geological investigation of the Fly River was conducted to assess the feasibility of transporting copper concentrates from OK Tedi via barge from Kiunga on the Fly River to an as-yet-to-be-selected deepwater port on the Gulf of Papua.

Other exploration was continuing on the Frieda River porphyry ore body estimated to contain 500 million tons averaging 0.5% copper. Although a major ore body was located in the Western Sepik Province, the development could be hampered by its low grade. The leases were held by MIM Holdings Ltd., and work carried out by Japanese interests earned them a 40% share in the holdings.

On Manus Island, 360 kilometers north of the PNG mainland in the Admiralty Group, joint venture exploration by Exoil NL and Transoil NL indicated 160 million tons of ore at 0.32% copper, associated with gold, silver, and molybdenum, in ore of several known prospects. Some factors acting in favor of the Manus prospect were the limited infrastructural development required and relatively good accessibility compared with the mainland deposits.

Gold and Silver.—With rapidly rising prices, gold continued to be an important byproduct of BCL's Panguna copper mine. The combined gold sales totaled some 1.4 million troy ounces during 1978 and 1979. Byproduct silver recovery was also increased.

Output by New Guinea Goldfields Ltd., operated at Wau, where ore averaged 0.08 ounce per ton, remained relatively small. Placer Ltd. was continuing exploration work on a gold prospect at Porgera in Ega Province. Metallurgical work was being carried out by Consolidated Gold Fields Australia Ltd., which has an option to take up a substantial interest if data look promising.

Mineral Fuels.—*Petroleum.*—Petroleum prospecting continued, but no significant discoveries were reported. In August 1978, the Papua New Guinea Government signed petroleum prospecting concession agreements with Gulf Oil Corp., Australasian Oil Ltd., and BP Petroleum Development Australia Pty. Ltd. The concession areas involve two permits (Nos. 76 and 77). Permit 76 covered 7,300 square kilometers in the Western Province, and 77 covered 13,400 square kilometers in the Western and Southern Highlands Provinces. The cost of the exploration program over a 3-year period was estimated at $7 million. In another development, Esso Papua New Guinea Inc. announced it had spudded the Goari No. 1 well on the Paibuna River, 415 kilometers northwest of Port Moresby. Planned depth is 11,500 feet, and it is estimated that the well would take 55 days to complete.

According to legislation recently passed, the PNG Government would receive 60% to 80% of any future revenues from oil or gas production. Also, the Government would receive a 1.25% royalty based on wellhead values, a petroleum income tax of 50% of taxable income, a profits tax after an agreed rate of return is achieved, and a Government equity up to 22.5% with payment from the Government's share of production.

Table 7.—Papua New Guinea: Exports of copper, by destination

(Thousand metric tons, Cu content)

Destination	1976	1977	1978
China, Mainland	--	2,983	6,049
Germany, Federal Republic of	85,300	104,777	62,732
Japan	87,500	58,700	98,303
Korea, Republic of	--	1,515	1,448
Spain	--	14,054	16,152
Other	6,300	--	5,928
Total	179,100	182,029	190,612

Source: World Bureau of Metal Statistics. World Metal Statistics (London). V. 33, No. 1, January 1980.

SOLOMON ISLANDS

Solomon Islands (formerly British Solomon Islands) became an independent nation on July 7, 1978. Inasmuch as the Solomons had been self-governing since 1976, independence did not bring major changes in the minerals industry, which was quite small. The only production in 1978 and 1979 was small quantities of alluvial gold and silver, valued at an estimated $200,000.[5] In addition, marine shells have been harvested for lime, but production was not reported.

The Government was actively seeking investment as a major force in the country's natural resource development. A bauxite mine and smelter project on Rennell and Vaghena Islands have been surveyed but temporarily shelved due to low world bauxite prices. Conzinc Riotino Australia Ltd. (CRA), in partnership with Mitsui Mining and Smelting Co. Ltd. and the Solomon Islands Government, withdrew from the project, and Mitsui decided to defer further work because of the lack of market for aluminum. The project was to produce 1.5 million tons of bauxite and 600,000 tons of alumina per year from reserves estimated at 60 million tons of 45%-50% Al_2O_3.

The Solomon Islands Government announced in September 1979 that the natural resources of the country, including its offshore areas, would be explored and evaluated as quickly as possible. The Government was particularly interested in receiving proposals for hydrocarbons both onshore and offshore. A Petroleum Act that would establish the framework to enable orderly prospecting and development to be carried out by commercial companies was at an advance stage of preparation. Within the terms of the act, detailed agreements between individual companies and the Solomon Islands Government concerning work programs, expenditure levels, the extent and nature of Government participation were considered.

TONGA ISLANDS

Webb Tonga, subsidiary of Webb Resources of Colorado, an independent U.S. oil company, drilled three onshore holes on Tongatapu, the island center of the Kingdom of Tonga. All three Webb holes were dry, and the company never found the submerged reef it was looking for. The Tonga Government and Webb Resources were conducting negotiations for Webb to drill two offshore wells in 2 to 3 years.

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[1] Supervisory physical scientist, Branch of Foreign Data.

[2] Where necessary, values have been converted from Fijian dollars (FD) to U.S. dollars at the rate of FD1=US$1.18.

[3] Where necessary, values have been converted from Communaute Financiere Pacifique Franca (CFPF) at a rate of CFPF 81.86=US$1.00.

[4] Where necessary, values have been converted from Papua New Guinea dollars (K$) to U.S. dollars at the rate of K$1=US$1.45.

[5] In October 1977, the Solomon dollar ($S) was introduced initially on par with the Australian dollar. Where necessary, values have been converted to U.S. dollars at a rate of $S1=US$1.15.

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